EXHIBIT 3
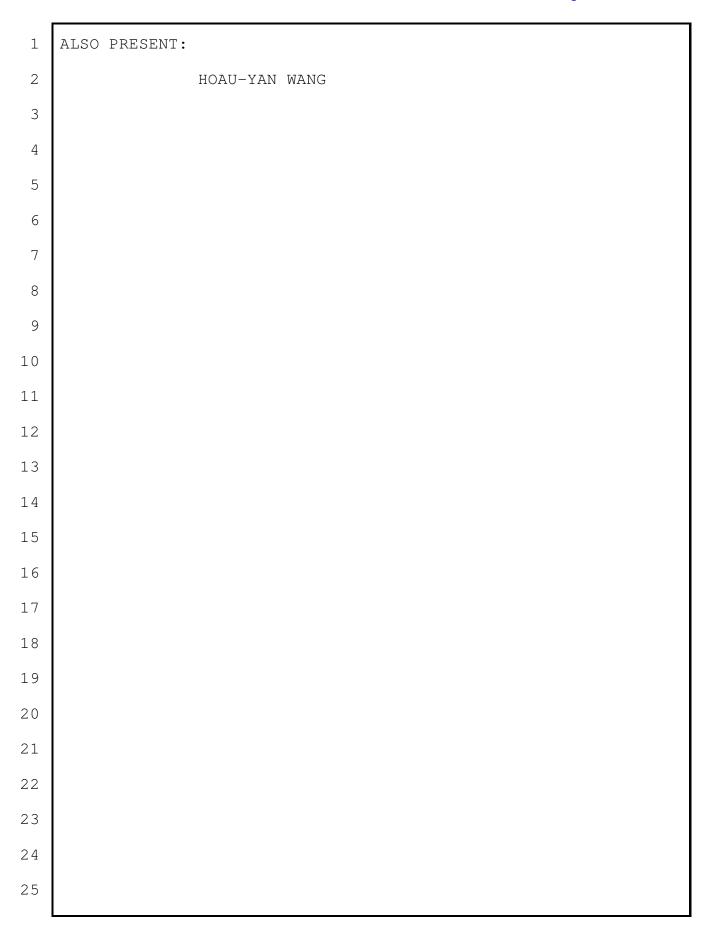
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 1                  IN THE UNITED STATES DISTRICT COURT
                      FOR THE DISTRICT OF MARYLAND
 2                          SOUTHERN DIVISION
    _____
 3  UNITED STATES OF AMERICA      )
                                  )
 4       Plaintiff,               )
                                  )
 5          vs.                   )Case Number
                                  )8:24-cr-00211-TDC-1
 6  HOAU-YAN WANG                 )
                                  )
 7       Defendant.               )
    _____)
 8
                       TRANSCRIPT OF MOTIONS HEARING
 9               BEFORE THE HONORABLE THEODORE D. CHUANG
                     UNITED STATE DISTRICT JUDGE
10              TUESDAY, SEPTEMBER 30, 2025 at 9:04 a.m.

11  APPEARANCES:

12  On Behalf of the Plaintiff:

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25     ***COMPUTER AIDED TRANSCRIPTION OF STENOTYPE NOTES***
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2

1   ALSO PRESENT:

2   HOAU-YAN WANG

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 1   **DEPUTY CLERK:** All rise. The United States District

 2   Court for the District of Maryland is now in session. The

 3   Honorable Theodore D. Chuang presiding.

 4   **THE COURT:** Thank you. Please be seated.

 5   **DEPUTY CLERK:** The matter now pending before this

 6   Court is Criminal Action Number 24-0211-TDC, United States of

 7   America versus Hoau-Yan Wang.

 8   We are here today for the purpose of a Daubert hearing.

 9   Counsel, please identify yourselves, for the record.

10   **MR. TYLER:** Good morning, Your Honor. Andrew Tyler

11   for the United States. I'm joined here at counsel table also

12   by our paralegal, Anna Cornich, and I'll let my colleagues

13   introduce themselves.

14   MR. SRIDHARAN: Good morning, Your Honor. Vasanth

15   Sridharan on behalf of the United States.

16   MR. PATHAN: Good morning, Your Honor. Kashan Pathan

17   on behalf of the United States.

18   **THE COURT:** Okay. Good morning, everyone.

19   **MS. BEIDEL:** Good morning, Your Honor. Jennifer

20   Beidel and Emma Blackwood on behalf of Dr. Hoau-Yan Wang.

21   **THE COURT:** Good morning. Good morning, Dr. Wang.

22   So we are here for a hearing on basically on the motions

23   regarding -- well, the motions in limine regarding expert

24   witnesses, primarily the one regarding Dr. Brookes which I

25   think is sort of the gateway to the other motions.

1   I've reviewed the briefs and the exhibits. I do have some

2   questions. I, frankly, think this is the kind of issue that

3   requires me to understand exactly what this witness would

4   testify to both as qualifications and his opinions and what the

5   counter-arguments are.

6   As you know and the case law sometimes in a civil case we

7   can do that through deposition transcript review, but this is

8   not a civil case, so are we prepared to have Dr. Brookes

9   testify today?

10   **MR. TYLER:** Yes, Your Honor. We prepared pretty

11   extensive testimony for Dr. Brookes today. Also just to

12   apprise the Court, he does have a very hard stop at 2:30 this

13   afternoon because he's chairing a thesis defense that he's

14   arranged to do remotely, but still --

15   **THE COURT:** Can you just speak into the microphone?

16   **MR. TYLER:** I'm just reminding the Court that Dr.

17   Brookes has a 2:30 hard stop this afternoon because he's

18   chairing a thesis defense which he's arranged to do remotely,

19   but, obviously, will need to be off the stand to do that at

20   that time.

21   **THE COURT:** I didn't know that before, but, honestly,

22   I didn't -- I was hoping it would not take that long, so I will

23   see how that goes. I think I have a sentencing hearing at 2:30

24   myself. Let's just get going and see how it goes.

25   Is there anything we should discuss, though, before the

1   testimony from either side?

2   **MR. TYLER:** Not from the government, Your Honor.

3   **MS. BEIDEL:** Not from the defense either, Your Honor.

4   **THE COURT:** So why don't we have him come forward.

5   **GOVERNMENT TESTIMONY**

6   – – –

7   PAUL BROOKES, after having been duly

8   sworn, was examined and testified as follows:

9   – – –

10   **DEPUTY CLERK:** And please spell your first and last

11 name, for the record.

12   **THE WITNESS:** P-a-u-l B-r-o-o-k-e-s.

13   **DEPUTY CLERK:** Thank you, sir.

14   **THE COURT:** Go ahead.

15   **DIRECT EXAMINATION**

16 **BY MR. TYLER:**

17 **Q.**   Good morning, Dr. Brookes.

18 **A.**   Good morning.

19 **Q.**   Could you tell us your title of witness?

20 **A.**   I'm a tenured professor of anesthesiology at the

21 University of Rochester Medical Center.

22 **Q.**   And could you give us a little bit about your educational

23 background?

24 **A.**   Yes. I received my PhD at University College, London, in

25 biochemistry in 1993. I then went to Cambridge University in

1 the U.K. and got a PhD also in biochemistry in 1997. I, then,

2 did a post-doctoral fellowship at the Institute of Neurology in

3 University of London for a year and a half before moving to the

4 U.S.

5 **Q.**   With respect to your time at undergrad, did you do any

6 work with respect to neuroscience during that time?

7 **A.**   Yes. I was a lab technician in the lab in the Institute

8 of Neurology which is connected with University College London.

9 That's the lab that I returned to as a post-op fellow.

10 **Q.**   And did your doctoral training include statistical

11 training?

12 **A.**   Yes, it did.

13   **MR. TYLER:** Ms. Cornich, if you could pull up

14 Exhibit-34, please.

15 **BY MR. TYLER:**

16 **Q.**   Dr. Brookes, could you tell us what this is?

17 **A.**   This is my academic CV.

18 **Q.**   And does that CV contain a lot of information about your

19 society memberships, awards, N.I.H. grants, reviewed

20 publications, conference, abstracts, et cetera?

21 **A.**   Correct.

22   **MR. TYLER:** At this time the government would like to

23 move into evidence Exhibit-34.

24   **THE COURT:** Okay. Exhibit-34 is in evidence. I

25 think, am I correct, the binders I have correspond to what you

1   are referring to?

2   **MR. TYLER:** Yes, Your Honor.

3   **THE COURT:** Do you know whether any of the exhibits

4   will have objections?

5   **MR. TYLER:** I do not, Your Honor.

6   **THE COURT:** Well, just to kind of be efficient, as

7   you know from my procedures, I want to make sure all the

8   exhibits are offered and admitted so the record is clear, but

9   ideally, if there is no objections, we can kind of move more

10   swiftly and maybe even do them in groups, so I'm counting on,

11   Ms. Beidel, if you could just jump up right away if there is an

12   issue, or when there is an opportunity to confer of what is

13   objected to and what is not.

14   So Exhibit-34 is in evidence.

15   **MR. TYLER:** Thank you, Your Honor.

16   Ms. Cornich, could you also bring up Exhibit-35?

17   **BY MR. TYLER:**

18   **Q.**   And, Dr. Brookes, can you tell us what this is?

19   **A.**   This is a shorter version of my CV focusing my work in the

20   area of research integrity.

21   **MR. TYLER:** At this time, the government also move

22   into evidence Exhibit-35.

23   **THE COURT:** Okay. Exhibit-35 is in evidence for

24   purposes of the hearing.

25   **BY MR. TYLER:**

1 Q.   Dr. Brookes, you mentioned your time at the Institute of

2 Neurology. What did you work on while you were there?

3 A.   I was working in a lab studying mitochondria in the

4 context of Parkinson's and Alzheimer's Disease.

5 Q.   When you came to the United States, where did you come and

6 what did you do there?

7 A.   I moved to the University of Alabama at Birmingham, also

8 working on mitochondria, but this time in the context of

9 cardiovascular disease.

10 Q.   During that time, did you do work with Western blots?

11 A.   Correct. UAB was where I was trained in the technique of

12 Western blots and regularly used that techniques.

13 Q.   Approximately, how many did you do per year during your

14 time there?

15 A.   I would estimate roughly a hundred Western blots a year,

16 so a couple a week.

17 Q.   Are you familiar with a technique called blue native gels?

18 A.   Correct. Blue native gel is a specific type of gel for

19 isolating protein complexes in their native format. And, in

20 fact, we developed a technique while I was at UAB in order to

21 be able to Western blot that type of gel which nobody had done

22 before.

23 Q.   Are you published on that topic?

24 A.   Correct. That is in a paper in the Journal of Proteomics

25 in 1992.

1 **Q.**   After you left the University of Alabama Birmingham, where

2 did you go from there?

3 **A.**   From UAB, I was recruited to the University of Rochester

4 in August of 20803.

5 **Q.**   And did you bring any funding with you when you came to

6 the University of Rochester?

7 **A.**   Yes. While I was a post-doc at UAB, I wrote and submitted

8 N.I.H. RO1 grant that was successfully funded, so then when I

9 arrived in Rochester, that was the funding that I brought with

10 me to start my lab.

11 **Q.**   And, generally speaking, what experience have you had with

12 N.I.H. grants since then?

13 **A.**   So, that grant that was awarded in 2003. I still have

14 that grant to this day. It has been continuously funded for

15 over 20 years. It's currently on its fifth funding cycle. In

16 addition, I've had another four RO1 grants as a principal

17 investigator, and I've been a coinvestigator on a number of

18 other grants from N.I.H., as well as other funding bodies.

19 **Q.**   During your time at the University of Rochester, have you

20 conducted Western blot experiments there?

21 **A.**   Yes. My lab still uses Western blotting to this day. I

22 would say anywhere between one and five per week depending on

23 what project we're working on. Again, averaging out to about a

24 hundred a year.

25 **Q.**   And do you do that using film still development or digital

1   development?

2   **A.**   Up until right before COVID, we used film development for

3   Western blotting and then right before COVID as the technology

4   became cheaper, we purchased a digital imaging system to

5   quantify those blots.

6   **Q.**   Dr. Brookes, do you also teach at the university?

7   **A.**   Correct. I teach in the medical school and the graduate

8   school.

9   **Q.**   And do you teach any courses relating to ethics?

10 **A.**   Yes. So there is a mandatory ethics course for all

11 incoming medical and graduate students and I teach one of the

12 modules in that course.

13 **Q.**   And during the course of your career, have you had any

14 experience consulting with private companies who are attempting

15 to develop drugs?

16 **A.**   Yes. I have consulted in on the advisory boards of a

17 number of early stage pharmaceutical companies. I've had

18 companies send drug material to my lab for experimentation via

19 material transfer agreements, as well as other types of

20 consulting work.

21 **Q.**   Turning to image analysis specifically, how did you first

22 start doing that?

23 **A.**   I was reviewing a grant for the American Heart Association

24 and I found, as is frequently the case when you are reviewing

25 grants in PDF format, you may use a split screen to view

 1 different parts of the grant at the same time. And I noticed

 2 that two of the images in the grant were duplicated to

 3 represent different proteins. The Western blot specifically

 4 had been reused and flipped around. I reported that to the

 5 AHA. I also forwarded my findings to the U.S. Office of

 6 Research Integrity. They subsequently performed an

 7 investigation and made a finding of misconduct against the

 8 author of that grant.

 9 **Q.**   Approximately, when was that?

10 **A.**   That was late 2010, early 2011.

11 **Q.**   And then what happened after that with respect to your

12 work on image analysis?

13 **A.**   I continued investigating any and all grants and papers

14 that came across my desk. I did, in fact, find some suspicious

15 images in papers from colleagues at my own university. I

16 reported those to my university and not much happened in terms

17 of action.

18   At the time there were a series of public facing blogs

19 where people would report on these types of issues with the

20 images and live sciences papers. And so in 2012, I decided to

21 join in and start an anonymous blog.

22 **Q.**   What work did you do for that blog?

23 **A.**   I found and reported on problem images in papers. Over

24 the course of the lifetime of that blog, we reported on about

25 300 papers. That resulted in several retractions and a number

1 of other outcomes for the authors of those papers.

2 **Q.**   At some point, did there come a time when you -- that blog

3 was de-anonymized?

4 **A.**   Yes. That was an anonymous blog. At the time I was a

5 fellow junior faculty member without tenure, so I considered it

6 necessary to remain anonymous. However, once my identity was

7 compromised, my university essentially got involved. They

8 essentially told me to shut down the blog and as somebody

9 without tenure, I didn't have much choice in the matter. I was

10 also told that my activities in that area were separate from my

11 university employment and, therefore, the university would not

12 be willing to provide me with any legal support. So I was

13 advised to obtain a lawyer and that lawyer was able to rebut

14 numerous attempts to sue me that were made.

15 **Q.**   And then after that time working in your personal

16 capacity, did you continue to do work in image analysis?

17 **A.**   Yes. I still do to this day. I have a master database of

18 several thousand examples of image analysis and image problems.

19 I continue to post using my real identity, my real name on a

20 public website known as Pub Peer. That is a website sort of a

21 clearinghouse for issues in the bioscience literature. My work

22 has led to hundreds of retractions of papers. In addition, my

23 collated databases and annotated databases and taxonomy of

24 image problems has been used by collaborators to train

25 machine-loading algorithms and AI. As you may be aware, there

1 are a number of AI detection tools for this type of image

2 problems nowadays.

3 **Q.**   Do journals consult with you for purposes of viewing that

4 image analysis?

5 **A.**   Yes. I am regularly requested to look over papers for

6 which editors may be suspicious of problems in the data.

7 **Q.**   Over the years, have you become familiar with various

8 tools that you used in this case to do analysis?

9 **A.**   Correct. Yes.

10 **Q.**   And that includes various PowerPoint Photoshop and image J

11 tools?

12 **A.**   Yes.

13 **Q.**   Are you familiar with published literature about image

14 analysis and research misconduct?

15 **A.**   Correct. Yes. And I have published in that area as well.

16 **Q.**   And are you familiar with something known as the JCB

17 standards?

18 **A.**   Correct. So that refers to a set of standards that were

19 first captured in an editorial in the Journal of Cell Biology

20 by the editor and chief at the time Mike Rossner and that

21 essentially describes what you are and are not allowed to do

22 with a scientific image when preparing it for publication. Do

23 you want me to go in to the details of that now or --

24 **Q.**   Yes. So what are those standards in the --

25 **A.**   So there are a couple of core concepts to that editorial.

1 One is that any manipulation of the scientific image should not

2 change the informational content of the image and then the

3 other principle is if an adjustment is made to an image, such

4 as brightness or contrast, the whole image must be adjusted

5 evenly across the field of view. It is not acceptable to

6 brighten or darken particular features of an image.

7 **Q.**   Why is it not okay to brighten or darken one image or one

8 lane? Sorry. One lane?

9 **A.**   Because that would change the informational content of the

10 image.

11 **Q.**   And is that informational content equivalent to the data

12 of the experiment?

13 **A.**   Sorry?

14 **Q.**   Is the informational content equivalent to the data of the

15 experiment?

16 **A.**   Yes. In the case of Western blotting, for example, the

17 darkness of the bands in the Western blot is the data. That is

18 the information contained within the image, but is then

19 subsequently used to draw a conclusion.

20 **Q.**   You mentioned AI learning a minute ago. Do there have to

21 be sufficient standards in order to make that type of analysis

22 codifiable?

23   **MS. BEIDEL:** Objection, Your Honor. I haven't been

24 objecting to the leading for purpose of facilitating this

25 hearing, but there is quite a lot of it and we are certainly

1 more interested in hearing Dr. Brookes' recitation of these

2 facts than Mr. Tyler's.

3   **THE COURT:** Okay. I understand the point and we

4 should be careful about that. Why don't you reask the

5 question?

6 **BY MR. TYLER:**

7 **Q.**   Dr. Brookes, with respect to AI software, how does that

8 work in terms of in order to be able to code it for software?

9 **A.**   So, first of all, you know, for AI in order to be able to

10 detect image problems, it needs a training set, but that

11 training set is useless unless taxonomy has been applied to

12 classify those examples of image manipulations. That taxonomy

13 could include things like has the image been flipped, has it

14 been darkened, has it been lightened, has it been recolored,

15 has it been resized, have more than one image been overlaid on

16 top of each other.

17   And so all of that information effectively is what is

18 known as codifiable. It means that the standards and what has

19 been done to the image can be distilled down into a set of

20 instructions and, therefore, a computer can learn that.

21 **Q.**   And you mentioned that you have been published on this

22 topic. Can you explain what you mean by that?

23 **A.**   So one of the papers that I published in that area, that

24 is actually a preprint on bio-archive, which is a preprint

25 server, that has not yet published, but that is a collaboration

1 with a group that is developing machine-loading algorithms.

2 Daniel Acuna and Konrad Kording.

3   The other paper is based on my experiences with the blog

4 which was essentially investigating the impact of public

5 discussion of problems in the bioscience literature on the

6 degree of action that is taken subsequently about those papers.

7   And the conclusion of that paper was public discussion of

8 problematic images in scientific papers results in between four

9 and seven fault greater levels of action. By action, I mean,

10 retractions, corrections and other things that journals do in

11 response to such allegations.

12   The third paper was published last year. That is

13 essentially an overview of the various tools available for

14 doing this type of image analysis. That was essentially a

15 conference proceeding. I was invited to a research integrity

16 conference at the University of Pennsylvania, and all the

17 speakers were invited to contribute a paper. As it ended up,

18 all being published in a special issue of a journal.

19 **Q.**   Have you also been invited to speak on this topic?

20 **A.**   Yes. The conference proceeding that I just mentioned is

21 one. I also participated in another conference during COVID

22 on-line in another panel and then, in fact, this fall I'm due

23 to sit on another panel at the annual meeting of the

24 Association of Research Integrity Offices, ARIO.

25 **Q.**   You mentioned hundreds of retractions. Have there been

1 any instances where you discovered you made a mistake?

2 **A.**   Yes. Everybody makes mistakes. One particular example is

3 I did call out an image on-line from a colleague at the

4 University of Rochester. He came angrily storming in to my

5 office and slammed down the original data on my desk and was

6 able to prove that it was not, in fact, manipulated. I

7 profusely apologized and we both moved on with our careers.

8 **Q.**   Do you consider that the information that you evaluated in

9 this case to be analogous to that?

10 **A.**   Could you repeat the question, please?

11   **MS. BEIDEL:**   Objection.

12   **THE COURT:**   Why don't you rephrase.

13 **BY MR. TYLER:**

14 **Q.**   Dr. Brookes, do you consider the amount of information you

15 have for it to do the work in this case analogous to the amount

16 of information you had in that instance?

17 **A.**   Specifically, generally, when investigating these types of

18 image issues in the literature, all you have is the published

19 figure. So it can actually be difficult to draw conclusions.

20 However, in this case, I was afforded access to significantly

21 larger amounts of data including some materials that we use to

22 prepare the final published figures. So this enabled us to

23 draw more certain conclusion.

24   **MR. TYLER:**   Your Honor, may I have a movement to

25 consult with defense counsel about exhibits?

1   **THE COURT:** Sure.

2   **MR. TYLER:** Your Honor, may I approach the witness?

3   **THE COURT:** Yes. Does he have these binders or not

4   or anyone like that or --

5   **MR. TYLER:** Your Honor, I have electronic versions

6   that he initialed yesterday which I was going to approach and

7   have him verify.

8   **THE COURT:** Okay. That's fine.

9   **MS. BEIDEL:** Your Honor, just to confirm --

10   **THE COURT:** Just pull the microphone up.

11   **MS. BEIDEL:** My apologies. We don't have objections

12   to any of the exhibits, except two that we are reserving on. I

13   think Mr. Tyler will tell you about that in a second, but just

14   for purposes of trial, we may have different objections that I

15   want to preserve.

16   **THE COURT:** No. I understand. I think we should

17   just use this for use of the hearing. There could be different

18   issues at the trial. I understand that.

19   **MS. BEIDEL:** Thank you, Your Honor.

20   **BY MR. TYLER:**

21   **Q.**   Dr. Brookes, do you recognize those disks in front of you?

22   **A.**   Yes. Those are electronic materials that I reviewed

23   yesterday and then subsequently initialed and dated.

24   **Q.**   Generally speaking, what are the contents of those

25   exhibits?

1 **A.**   They consist of PDF copies, as well as some Excel and

2 PowerPoint files.   The PDFs are the grants and papers, as well

3 as reports that I submitted.

4   **MR. TYLER:**   At this time, the government moves in to

5 evidence Exhibits-1 through 49.

6   **THE COURT:**   Exhibits-1 through 49 are in evidence for

7 the hearing.

8 **BY MR. TYLER:**

9 **Q.**   Now, Dr. Brookes, turning to Western blots.   Could you

10 tell us what the purpose of a Western blot is?

11 **A.**   A Western blot serves to measure the relative amounts of

12 protein in one or more biological samples.

13 **Q.**   And how is it measured?   What is it measured in?

14 **A.**   So in a Western blot, you're separating proteins and then

15 exposing them to antibodies.   The antibodies specifically

16 recognize the protein.   The antibodies then subject to a

17 chemical reaction that gives off light, so what you are

18 measuring in a Western blot is the amount of light given off

19 which is proportional to the amount of protein in a sample.

20 And that light is captured by a piece of x-ray film so the

21 darkness of the film correlates to the amount of protein in the

22 gel.

23   **MR. TYLER:**   Your Honor, may I approach the witness

24 again?

25   **THE COURT:**   Okay.

1 **BY MR. TYLER:**

2 **Q.**   Dr. Brookes, do you see an envelope with an exhibit

3 labeled 52?

4 **A.**   Correct. Fifty-two. Yes.

5 **Q.**   Can you tell us what is in there?

6 **A.**   These are some of the equipment and materials that are

7 typically used in the Western blotting process.

8 **Q.**   Could you describe that using those tools and actually

9 demonstrate how a Western blot is done?

10 **A.**   Yes. Okay. So, the first step is we have a pair of glass

11 plates that are separated by a spacer of 1.5 millimeters. We

12 fill the gap in between these two plates with a solution that

13 then sets that is a gel. So it's just like Jello that you

14 would eat at home. Right before it sets, we insert a small

15 thing called a comb in to the gel. Once the gel is set, we

16 remove the comb and that leaves behind a series of indentations

17 in the well which are known as wells.

18   The protein is then -- the protein samples are then loaded

19 in to those wells. We typically leave one well empty in order

20 to add a series of molecular weight markers in one of the

21 lanes. An electric current is then applied across the gel and

22 the proteins in this case are all coated with a molecule called

23 SDS. That's sodium dodecyl sulfate. That's a detergent. That

24 gives all the proteins a negative charge so they might

25 breakdown the gel towards the positive electrode. The proteins

1   are separated on the basis of their size.

2   So the small proteins migrate fast and end up at the

3   bottom of the gel. Whereas, the larger proteins are retained

4   at the top of the gel because they migrate more slowly. So you

5   can think of the gel as sort of a size siv. When the gel is

6   finished, we take the plate apart. We then put the gel in

7   another apparatus with a membrane. The membrane is made up of

8   paper called nitrocellulose which binds protein. We then

9   transfer the gel to this membrane. So that transfer process is

10   actually the blot. That is the process of Western blotting is

11   transferring the gel to the membrane. The reason we do that is

12   the gel is kind of floppy and fragile. The membrane is a piece

13   of paper which is robust which we can then do things do.

14   So the membrane is then subjected to a series of washing

15   steps and solutions containing antibodies and detection

16   molecules. You can see on the side of this gel, perhaps you

17   can see red and blue. Those are the molecular weight markers

18   in one of the lanes. And then we add a chemical which is going

19   to react with the antibody to give off light. And then we

20   place the membrane inside a cassette. This is a film cassette,

21   an x-ray film cassette.

22   So the membrane is placed in the film cassette in to the

23   cassette in a dark room is introduced a piece of x-ray film.

24   This is a blank piece of old film. The x-ray films goes in to

25   the cassette. The lid is closed for a set amount of time. Ten

1 seconds, 30 seconds, two minutes, five minutes.

2   After the given exposure, we take out the x-ray film and

3 we put it through a developer machine, and it develops the

4 Western blot, and so we get this type of image.

5   So this is a developed Western blot. The dark --

6   **THE COURT:** Can you point it towards me, would you

7 mind?

8   **THE WITNESS:** Sorry. The dark things are bands. The

9 dark things are bands and then alongside the bands we also

10 annotate the different molecular weight markers. The way we do

11 that is while we develop this x-ray film, the membrane stays in

12 the cassette so then when we have the developed film, we can

13 put this back into the cassette and transpose the molecular

14 weight markers and other details about the experiment onto the

15 film.

16   And so this developed film where you can see each -- there

17 is a date. The corner of the film is folded so we know which

18 was the top corner so we can orient it correctly. The details

19 of the antibody are written in the side and molecular weight

20 markers are listed down both sides of the gel.

21   So that's what we keep in a folder in the lab. That is

22 the Western blot in the developed form. That is the data.

23 **Q.**   And then once you have that, what is the next step?

24 **A.**   So, typically, we have a flat bad scanner in the lab. And

25 so we would take a digital scan of this piece of film, and then

 1 we use a software called Image J. That is a free software

 2 distributed by the N.I.H. and that is used to perform a process

 3 called densitometry. So densitometry is essentially

 4 determining the darkness of the bands in each lane which allows

 5 us to then get quantitative data out of this type of gel to

 6 make a graph.

 7 **Q.**   And, Dr. Brookes, are you also familiar with something

 8 called an isoelectric focusing Western blot?

 9 **A.**   Yes. So, the technique that I just described that was

10 called SDS Page. SDS, the detergent, and then polyacrylamide

11 gel electrophoresis. That gives everything a negative charge

12 so the proteins all move in one direction, so they are

13 separated by their molecular weight. If we do the gel slightly

14 differently, there is a technique called isoelectric focusing.

15   So we leave the SDS out and this time even without the

16 detergent, all proteins have a negative charge. Proteins are

17 covered with positive and negative charges. Every protein is

18 different.

19   And so we put the proteins in the gel on what is called a

20 pH gradient, so the pH ten is at the top. PH three is at the

21 bottom. And when we apply an electric current, the proteins

22 will move up and down the gel until they reach their happy

23 place, a point where they don't have a net charge. And that

24 point is called the isoelectric point. So we shorthand that to

25 PI.

1   So the isoelectric point, in effect, is the pH value at

2 which a protein no longer has a net charge. And, again, that

3 is different for all types of proteins.

4   The gel process is different. Once an isoelectric

5 focusing gel is complete, everything we described in terms of

6 taking that gel, imprinting it onto a membrane, putting the

7 membrane in the cassette with the film, putting the markers on

8 the piece of developed film, that whole downstream process is

9 the same.

10   **MR. TYLER:** Ms. Cornich, could you pull up

11 Exhibit-1A, Page 6?

12 **BY MR. TYLER:**

13 **Q.**   Dr. Brookes, could you tell us what this is?

14 **A.**   This is a Western blot from my laboratory, albeit quite

15 ugly one, but this is measuring the amount of a protein called

16 ALK BH7. You see that down in the bottom right. A-L-K B-H 7.

17 We call it ALK BH 7. The date is in the top left corner. The

18 four blue marks that you see around the edge of the blot, those

19 mark the corners of the membrane. On the left, you see a

20 series of bands that have been marked with blue and red. Those

21 are the molecular weight markers which were transposed from the

22 membrane.

23   And then in this case, we are comparing two different

24 types of mice. So, if you read along the top, you can see that

25 every pair of lanes, one says WT, that stands for wild type.

1 That is just the normal laboratory mouse. And the other band

2 next to it says ALK BH 7 minus slash minus. That is a mouse in

3 which that ALK BH 7 protein has been genetically deleted or

4 knocked out.

5 **Q.**   Dr. Brookes, with respect to the molecular weight markers

6 which you mentioned a couple of times, what is the purpose of

7 that?

8 **A.**   The purpose of that is to essentially tell us which band

9 to look for and to know that we are looking at the right

10 protein. So, it is fairly common, as you see here, this

11 Western blot was developed with an antibody against ALK BH 7.

12 But there are lots of bands. Not just a single band. So we

13 need to know which band to look for and so reading across the

14 lower red mark here, this is the 25-kilodalton molecular weight

15 marker. And if we read across, we can see that in particularly

16 the mito ALK BH 7 is a protein that resides inside

17 mitochondria.

18   So in this third set of lanes we see there is a prominent

19 band of 26 kilodalton in the wild type which is gone in the not

20 kept. And so that indicates the antibody is recognizing a

21 protein at the correct molecular weight and that band is gone

22 in the knock-out mouse. Therefore, that's the protein that we

23 need to be looking at.

24 **Q.**   If you were to go ahead and publish this, how would you be

25 able to figure out what the size of the kilodaltons was at that

1 point?

2 **A.**   So the relationship between the distance moved down the

3 gel in millimeters is a logarithmic function of the molecular

4 weight, so we literally measure down the gel with a ruler and

5 we plot a graph of distance versus the log of molecular weight,

6 and then we can read across and read down the gel and go to

7 that graph and know the molecular weight of protein.

8 **Q.**   Now, Dr. Brookes, during the course of your work on this

9 case, did you develop a report to discuss some of the tools

10 that you used to do your analysis?

11 **A.**   Yes.   There were three reports at the beginning that

12 described all of these various processes.

13   **MR. TYLER:**   And, Ms. Cornich, if you can bring up

14 Exhibit-51?

15   **THE WITNESS:**   Can I raise those -- how do I raise --

16 thank you.

17 **BY MR. TYLER:**

18 **Q.**   Dr. Brookes, could you tell us what this is?

19 **A.**   So this is a walk through that describes some of the

20 techniques that are used in order to find the irregularities or

21 other problems in Western blot images.

22 **Q.**   Are these some of the techniques and tools that you use in

23 your analysis in this case?

24 **A.**   Correct.   Yes.

25   **MR. TYLER:**   If you can go to the next slide.

1 **BY MR. TYLER:**

2 **Q.**   Dr. Brookes, if you could just walk us through this slide

3 show?

4 **A.**   Okay. So, there are two images in this case. Image two

5 on the right is from the paper. Image one was obtained from

6 the data set. And so the first step is to bring both of these

7 images in to Microsoft PowerPoint.

8   Next slide, please. This is just a screen capture from

9 Microsoft PowerPoint. We're selecting the image on the right

10 and then we can bring up the format picture dialogue. And as

11 you see over on the right using the red arrow, there are a pair

12 of sliders. We can slide left and right to adjust the

13 brightness and the contrast in order to enhance features in the

14 image.

15   Next slide, please. This is an example of that. This is

16 with the brightness turned down by 49 percent and the contrast

17 increased by 78 percent.

18   Next slide, please. We can then crop out using the crop

19 function in PowerPoint we can crop away the next.

20   Next slide, please. And, again, next slide.

21   This allows us to basically bring the figures next to each

22 other for a better comparison. So this is then the result of

23 that. And, as you can see, it's highlighted in the red box.

24 There are a number of common features and the noise in the

25 background of these images which lead us to conclude that they

1 are, in fact, originate from the same image.

2   It's notable the red box is just shown as an example here,

3 but you can essentially pick any area in the entire background

4 of this image and all of the noise pattern is identical between

5 these two images.

6   A similar technique can be used in Adobe Photoshop if that

7 is the preferred software. We can load the image in to

8 Photoshop as it's shown mere.

9   Next slide, please. And we pull up the curves function

10 from the menu. That brings up a dialogue box.

11   Next slide, please.

12   In the curves function, you will see a graph. The X axis

13 of the graph has a scale from black to white all the way

14 through gray in the middle. The Y axis of the graph has a

15 similar scale, so the X axis of the graph is basically the

16 input. It's saying, if you see a pixel of this density or this

17 darkness, then apply an adjustment to it to give the output on

18 the left.

19   So, in this case, there is no adjustment because the graph

20 itself is a straight line, but the dot in the middle of the

21 graph we can move up and down and left and right in order to

22 create a complex profile that is akin to adjusting the

23 brightness and contrast of the image.

24   If you go to the next slide, please.

25   So, this is a complex curve that has been applied and, as

1 you see it, not only brings out differences in the background

2 of the image, this can also be used to enhance features within

3 the individual bands in the middle of the bands which

4 previously appeared pure black.

5   So this is a somewhat more useful feature than simply

6 brightness and contrast.

7   Next slide, please.

8   Another example that can be used to pick out features in

9 blots is something called a gradient map. This is in Adobe

10 Photoshop again.

11   So this is under the same menu in Photoshop, the

12 adjustments menu, we click gradient map and that brings up a

13 dialogue box where we are faced with a number of different

14 color of choices. We can select any number of gradient maps in

15 order to enhance or bring down features of the image and,

16 again, it should be known we are adjusting the entire image

17 here, not individual parts of the image. All of the image is

18 being treated equally.

19   On the next slide, you can see three examples of that.

20 These are just three different color gradient maps that have

21 been applied. Some of them pick up different features than

22 other ones. And so these will be used then in a similar way to

23 compare background features, background noise, band, smears,

24 smudges in there.

25   Next slide, please.

1   If in the rare situation that we can't find an appropriate

2   gradient map from that large list of possibilities, there is

3   the possibility here to go in to what is called the gradient

4   editor where we can slide those color sliders left and right in

5   order to find an appropriate threshold or adjustment.

6   That is equivalent to essentially applying the curves

7   function in order to find something that will pick up on

8   certain features.

9   Next slide, please.

10   So the last example here, this is an example of using

11   something in Adobe Photoshop which is called a droplet.

12   Next slide, please.

13   So a droplet is essentially a macro or a plug in. It's a

14   set of predefined instructions telling Photoshop what to do and

15   the droplets in this case are distributed by the Office of

16   Research Integrity. This is the webpage where anybody can go

17   download these droplets from ORI, plug them into Photoshop and

18   it will perform this set of actions automatically with very

19   little user input as a standardized way of doing this.

20   Next slide, please. So this is an example of that. This

21   is figure one from the grant application.

22   Next slide, please. This same figure was, in fact, also

23   shown in a paper in Neurobiology of Aging. You can see by just

24   looking at the band pattern that these images are similar, but

25   what the goal of this analysis is to show that they actually

1   share a common digital heritage.

2   Next slide, please. So this is a PowerPoint file as well,

3   so we can actually take the PowerPoint file which was used to

4   prepare the grant for the paper image.

5   Now, in this case, Photoshop cannot recognize PowerPoint

6   files. One is made by Microsoft and one is made by Adobe and

7   they don't play nice. So we have to actually extract the image

8   from the PowerPoint file in order to be able to analyze it in

9   Photoshop. So that is done simply by right clicking and saving

10 it.

11   The image that we are going to compare that to is this

12 image here. This is an image that was provided to me during

13 the investigation in which there is an area in the top right

14 corner where a white box appears, and we have taken part of

15 that image, highlighted it in red and cropped it and saved it,

16 and that is the other image.

17   Next slide, please. So this is both images loaded in to

18 Adobe Photoshop. Over on the right is a series of menus. This

19 is called the actions menu. You can read the word actions in

20 tiny tiny print at the top. These -- this long list of things

21 these are the various droplets. They come as a package from

22 the ORI.

23   So the first step is we select the droplet that we want

24 which is open at the moment, and down in the far bottom right

25 corner you see there is a little play icon just like on your

1   music player, so we hit the play icon.

2   Next slide, please. And the first step is the macro runs.

3   It does some basic transformations to the image first. It

4   makes a gray scale and then brings it back. And then applies a

5   gradient map to the image. So this is a red gradient map.

6   These are preset within the ORI droplet.

7   On the next slide you can see we are applying a different

8   gradient map. Blue in this case or cyan to the other image.

9   Next slide, please. The next step is we actually bring

10   the images together. So in this case the image on the right

11   has been copied and pasted over into the image on the left.

12   That results in the two different images showing up in the

13   left-hand window as different layers.

14   And the first thing we're asked to do is then apply a

15   curve so you see again a curve dialogue box, so we apply a

16   curve to the first layer.

17   And the next slide. Then we apply a curve, the same

18   curve. The numbers in the curve boxes are the same so we apply

19   the same curve to the second layer.

20   Next slide, please. And then now that we have got both

21   images, both with the gradient map, both with curves applied,

22   we can have them in the same window, and we have this

23   double-layered image that we can use for comparison.

24   Next slide, please. The next step is then to apply what

25   is called a free transform to layer one. All that is is

1   basically a dialogue that allows us to move and resize the

2   image in order to line it up against the other one.

3   Next slide, please. So this is, for example, the image

4   that's been resized. This is before the images have been

5   aligned properly.

6   What you can see here is that anywhere there is red that

7   is contribution for one of the images. Anywhere there is cyan

8   that is contribution of the other images, but then anywhere

9   within this white box in the middle, if there was any overlay

10 between the band content that would show up as black.

11   And so on the next slide you can see that is essentially

12 exactly what happens. When the two images, those -- all that

13 has happened between that previous slide and this slide is to

14 just move one image over the other image. When they line up

15 perfectly, all the red and the blue disappears, and we have a

16 perfect alignment with black. And this indicates that these

17 are, in fact, the same image. And we can blow that up and look

18 at it on the next slide I believe.

19   One final step. If you want to save this, we merge the

20 layers together and then on the next slide we use the save as

21 dialogue box so we now have a single image. We save it as just

22 a JPEG file.

23   On the next slide, please. Once we have saved it, this is

24 then a blow up of the area of interest and so as you can see,

25 there is basically no red and cyan here. It's all black.

1 These images align perfectly.

2 **Q.**   Just one additional question on this, Dr. Brookes. With

3 respect to the black, is there -- did you use a different color

4 when you were doing your other reports?

5 **A.**   Yes. Sometimes depending on, you know, which install of

6 Photoshop you are using, the presets of the gradient maps that

7 are applied are slightly different, so I believe in some of the

8 analyses the overlap appears in cyan or red, but the principle

9 is essentially the same.

10   Which color is which is described in the text of the

11 reports.

12 **Q.**   And this slide show we just went through, is that

13 something you prepared?

14 **A.**   Yes.

15   **MR. TYLER:** At this time the government would like to

16 move into evidence Exhibit-51.

17   **THE COURT:** I thought it was already in. No?

18   **MR. TYLER:** This is one of the ones that was reserved

19 up.

20   **THE COURT:** Okay.

21   **MS. BEIDEL:** Could we understand when it was

22 prepared?

23   **THE COURT:** Yeah. I'm actually not sure what this

24 is. I mean, is this --

25   **MR. TYLER:** This is just a --

1   **THE COURT:** It's going to be used in the trial. Is

2   this just an example of how things work by using Dr. Brookes'

3   own data, Dr. Wang's data, somebody else's data? What is it?

4   Maybe you should ask more questions on that front.

5   **MR. TYLER:** Yes.

6   **BY MR. TYLER:**

7   **Q.**   Dr. Brookes, when did you prepare this?

8   **A.**   This was prepared last week.

9   **Q.**   And the images that we're looking at, whose images are

10 these?

11 **A.**   These are images from the case that were provided to me,

12 so they're being used here purely on an example basis to

13 demonstrate the techniques. They happen to be very good

14 examples of images that overlap.

15 **THE COURT:** So it's not necessarily something you

16 would use, Mr. Tyler, not necessarily something you would use

17 at trial, but just to illustrate the technique?

18 **MR. TYLER:** Yes. And if we were to use it at trial,

19 it would be a demonstrative just to show how this works.

20 **MS. BEIDEL:** Your Honor, my understanding is that

21 this report corresponds to Dr. Brookes' previously produced

22 report 4.8. However, that 4.8 report does not use this droplet

23 method.

24 Our view is this has been manufactured very recently,

25 wasn't disclosed in expert discovery, and it's not appropriate

1   for Dr. Brookes to be adding additional methods to bolster his

2   opinions at this time, so we object to the admission of this

3   document.

4   **THE COURT:** What about that? Does this come from the

5   prior report or is it a new analysis?

6   **MR. TYLER:** It is a new analysis, but from our

7   perspective, Your Honor, it's just showing how the tool works.

8   It is not an opinion in and of itself.

9   **THE COURT:** Were these particular droplets used in

10   the analysis that you plan to use at trial?

11   **MR. TYLER:** Yes.

12   **THE COURT:** In this exact same fashion?

13   **MR. TYLER:** Yes, Your Honor.

14   **MS. BEIDEL:** That's incorrect from what was disclosed

15   to us, Your Honor. There's either a disclosure issue or that

16   is not a correct representation.

17   **MR. TYLER:** The example -- the techniques -- and we

18   can walk through this in some other examples, Your Honor, that

19   we have. The technique is something that will be used at

20   trial. This specific PowerPoint presentation was just put

21   together as an example of how --

22   **THE COURT:** Why weren't we just using the one that

23   you are going to use at trial? It seems to me that would be

24   easier.

25   **MR. TYLER:** The one we are going to use at trial --

1   **THE COURT:** Are they different in some way?

2   **MR. TYLER:** Essentially it is just the last slide

3 here. So, for Your Honor's benefit, we are trying to show what

4 the steps are to get to that last slide to show how that

5 actually came to be.

6   **THE COURT:** Okay. Well, I mean, I think for purposes

7 of this hearing we are trying to understand the techniques and

8 so forth, I'm going to allow it. But, again, it does not mean

9 we are going to use it at trial and I think we should have

10 cross-examination on sort of how this compares or does not

11 compare to what was actually done, and I generally agree with

12 the principle that if it's not something that was disclosed

13 previously, you are going to have a problem getting it in at

14 trial so.

15   But for purposes of just understanding the technique --

16 again, it's not clear to me this was the same technique used,

17 but we will find out after cross-examination.

18   **MR. TYLER:** Thank you, Your Honor.

19   **THE COURT:** Go ahead.

20 **BY MR. TYLER:**

21 **Q.**   Now, Dr. Brookes, turning to the source of the materials

22 that you used for your actual analysis, what were the sources

23 of materials that you used?

24 **A.**   In the case of grants and source images, they were sent to

25 me by Agent Jeffrey Weeks of the FBI.

1 **Q.**   And what were those?

2 **A.**   They were PDFs of grants, as well as JPEG images. In

3 addition, in some cases, there were papers. I was able to

4 obtain those papers myself because they are freely available

5 and public through my university library subscription.

6 **Q.**   In addition by e-mail, is there other ways you obtained

7 information from Special Agent Weeks?

8 **A.**   Yes. I was sent a pair of DVDs containing one DVD

9 contained approximately 2,300 JPEG images and another DVD

10 contained approximately 2,900 PowerPoint files.

11 **Q.**   I apologize if you already said this. But did you also

12 receive the grant applications?

13 **A.**   Yes. As I mentioned, the grant applications were in PDF

14 format sent by Agent Weeks.

15 **Q.**   Turning to before -- I guess last thing before we get to

16 the analysis, which is Dr. Brookes, did you do a report which

17 described your general method of how you plan to approach this

18 analysis?

19 **A.**   Correct. Yes. The general methods that we applied were,

20 first of all, we -- sorry. I keep saying we. I. I had a PDF

21 of the grant with a figure in the grant that was the figure in

22 question, as well as image that was known as a white box image.

23 It will become apparent what we are talking about in a second.

24   So the first step was to try to work backwards from the

25 grant to see if any -- if the white box image was, in fact, the

1 source for the grant image, so that was -- that was termed a

2 reverse analysis. So the objective there is working backwards

3 to try to trace the chain of provenance for the data in the

4 grant.

5   In addition to that, I performed a forward analysis in

6 which I was presented with a related raw image, a raw Western

7 blot with no annotation or white box on it. Working forward

8 hypothesizing, can we create the image in the white box or the

9 final published grant figure from the raw image, so

10 hypothesizing whether that can be done.

11 **Q.**   Generally speaking, how does that approach align with the

12 scientific process, in your view?

13 **A.**   Essentially -- I mean, it aligns on a couple of different

14 manners. One is when we're performing a reverse analysis, we

15 are essentially trying to establish as scientists, when

16 performing these kind of experiments, what is the chain of

17 custody or the chain of provenance of the data. It's an

18 essential part of the scientific process. The data should be

19 traceable to the raw data from which it came.

20   And then in the forwards case what I'm essentially doing

21 is starting with the hypothesis. The hypothesis is that this

22 image can be manipulated in a fair and standardized manner

23 using approved tools in the field, such as adjusting the

24 brightness and the contrast evenly across the entire image, and

25 that will bring about the bands or the pattern of bands or the

1 final data that is in the white box or the final published

2 image.

3 **Q.**   Dr. Brookes, in that -- not in that report, but in other

4 reports did you consider potential alternatives, explanations

5 for your analysis?

6 **A.**   Yes. A lot of alternative explanations were explored.

7 One in particular which I don't think is possible. When a

8 Western blot is run, quite often if the result turns out messy,

9 maybe there is a fingerprint in the middle of the film or a

10 band didn't come out properly, it can be fairly common to use a

11 process which is called stripping and reprobing. So we take

12 the membrane, wash away all the antibody and go back with a

13 fresh match of antibody and redevelop a completely brand new

14 piece of film. That's called stripping and reprobing. That is

15 possible, but what that does is it results in a completely

16 different background image because when you strip and reprobe,

17 you are taking the membrane out of the cassette, bits of dust,

18 bits of hair, whatever, get on it. It's going to get

19 scratched, washed around in the dish. When we put it back into

20 the cassette, it's going to be in brand new wallet binder which

21 has got different creases and things on it.

22   So, when a second piece of film is developed from that

23 membrane, there is absolutely no chance that the exact same

24 pattern of noise can be reproduced on that second piece of

25 film.

1   So stripping and reprobing was one specific alternative

2 that we ruled out as a possibility.

3   **MR. TYLER:** Now, turning to the analysis.

4   Ms. Cornich, could you unplug Exhibit-39, Page 60?

5 **BY MR. TYLER:**

6 **Q.** And, Dr. Brookes, could you tell us what we're looking at

7 here?

8 **A.**   This is a page from an N.I.H. grant and figure one of the

9 grant shows an isoelectric focusing gel.

10   **MR. TYLER:** Ms. Cornich, if you could also bring up

11 Exhibit-37, Page 7.

12   **THE WITNESS:** At the top of the page on the left you

13 see the same data published in a paper in the Journal of

14 Neurobiology of Aging. These are the same data as shown in the

15 grant.

16 **BY MR. TYLER:**

17 **Q.** Dr. Brookes, could you explain just what the -- basically

18 what the information being conveyed here is?

19 **A.**   Yes. So this is an isoelectric focusing gel. Along the

20 left-hand edge, you can see there is a scale. That is a pH

21 scale. So 9.5 means the isoelectric point at which the protein

22 has no charge would be a pH of 9.5 and the same down at the

23 bottom is 3.5. So, typically, when these experiments are done,

24 they are done on a pH gradient of three to ten. Three to ten

25 is the maximum range here.

```
 1        In the first three lanes of the Western blot, the first

 2   three bands that you see, those are from controlled samples.

 3   The second set of three bands are from Alzheimer's Disease

 4   samples.  Along the bottom, you can see PTI 125 or animalia.

 5   Where there is a plus below the third lane, that indicates

 6   that's a sample which has been treated with the drug PTI 125.

 7        What you can see by comparing the first lane and the

 8   fourth lane is that in a controlled sample the isoelectric

 9   point of the protein is 5.9.  It roughly lines up with six on

10   the left-hand scale.  In the Alzheimer's sample, it has shifted

11   down to about 5.2, 5.3.

12        This is used to make the claim that Alzheimer's results in

13   a confirmational shift of the protein.  The reason isoelectric

14   focusing is done in this case is because, as I mentioned, all

15   proteins have a native negative charge with positive and

16   negative charges, but when proteins fold differently, that can

17   cause, for example, one area of a protein to be covered up and

18   that can obscure positive or negative charges, and that can

19   change the isoelectric point.

20        So we can see in the fourth lane across the band has

21   shifted down.  If we then turn our attention to the sixth lane,

22   what appears to happen in the sixth lane --

23            THE COURT:  Can you just describe what you mean by

24   "lane"?  Can you point or circle?  You can mark it.

25            THE WITNESS:  A lane is a vertical designation.
```

1   **THE COURT:** So maybe you can just point to the ones

2   you are referring to.

3   **THE WITNESS:** So this will be lane number one. This

4   will be lane number three versus four. This is lane number

5   six.

6   **THE COURT:** Thank you.

7   **THE WITNESS:** And so comparing the middle two lanes,

8   three versus four, you can see Alzheimer's Disease introduces a

9   shift in the isoelectric point of the protein. It's moving

10 down the gel further. And then in the very last lane PTI 125

11 over on the far right appears to reverse some of that shift.

12 It brings some of the protein back up the gel to make it more

13 similar to what we see in the control condition.

14 **BY MR. TYLER:**

15 **Q.**   So, in layman's terms, what does that mean?

16 **A.**   So that is -- that is essentially saying that the drug

17 appears to reverse the conformational change that is happening

18 in the protein in Alzheimer's Disease.

19 **Q.**   And then, also, Dr. Brookes, can you explain the

20 relationship to the bar charts in the middle?

21 **A.**   Yes. So the bar chart in the middle is essentially a

22 quantitation of the amount of each of the two different

23 isoelectric points.

24   So the white bars would be the density of a band with an

25 isoelectric point of 5.9. The black bar is the density of a

1 band with an isoelectric point of 5.3. And as you see here in

2 the control, just as in the control here, there are all of the

3 protein appears to be in the 5.9 state as indicated by the fact

4 that there are tall white bars with no black bars.

5   However, again, in Alzheimer's in the fourth lane there

6 appears to be a shift where now most or all of the protein is

7 in the 5.3 state, so now the white bar has gone down. The

8 black bar has come up. And then over in the far right you can

9 see that there is a mixed population. There are both white and

10 black bars as if the -- some of the protein that was in the

11 lower state has been shifted to the higher state by the drug.

12   This graph here is a quantitative graph of the density of

13 these bands and you can see in the figure legend down here it

14 states N equals six. N in biological sciences when we are

15 referring to this in science, the N is the number of

16 replicates.

17   So the figure legend is stating that these data are the

18 average of six independent times that this experiment was

19 performed.

20 **Q.**   Dr. Brookes, could you explain what the little like T

21 looking bars on the top of the bars, what that indicates?

22 **A.**   Yes. So when we -- when we perform these types of

23 experiments, you never get the same answer twice. Right.

24 There is a joke among researchers, if every experiment worked

25 the first time, it wouldn't be called research.

1   And so the quantification of the bar, the density, the

2 average is given by the height of the bar. The little T thing

3 above is called an error bar, and that is an expression of the

4 range or the variance of the result.

5   So a very small or tight error bar, as you see here,

6 indicates an experiment that gives you the same result every

7 time. The result is very reproducible and tight. A bigger

8 error bar would indicate more variance in the result and

9 because experiments are varied, it's often necessary to perform

10 them multiple times such as six times in order to see a

11 significant difference.

12 **Q.**   Thank you, Dr. Brookes. This figure which we noted here,

13 did you see this reproduced across more than one grant

14 application?

15 **A.**   Correct. Yes. I believe four different grants.

16   **MR. TYLER:** Now, Ms. Cornich, if you could pull up

17 Exhibit-10A?

18   **THE WITNESS:** Can we delete the -- thank you.

19 **BY MR. TYLER:**

20 **Q.**   Dr. Brookes, could you explain what this is here?

21 **A.**   So this is a report that I authored regarding figure one

22 from the N.I.H. grant proposal.

23   **MR. TYLER:** And, Ms. Cornich, we can go to the next

24 slide.

25 **BY MR. TYLER:**

1   **Q.**   And Dr. Brookes, what is -- what do we see here?

2   **A.**   This is the figure from the grant from the paper. They're

3   the same figure.

4   **MR. TYLER:**   And Ms. Cornich, if we could go to the

5   next slide?

6   **BY MR. TYLER:**

7   **Q.**   Dr. Brookes, could you tell us what we see here and what

8   you did here?

9   **A.**   Okay. So on the top right where it says C, final

10 published, that is the image from the grant. Over on the left

11 there is an image that I call the white box image. You will

12 see from the title of this JPEG file, C is controlled. AD is

13 Alzheimer's Disease. FLNA is Filamin A conformation. IEF,

14 this is an isoelectric focusing gel-11. Numerous of the white

15 box images that I encountered in this analysis had the number

16 11 appended to the file name.

17   The whole image, as you see it, is essentially a scan of a

18 piece of film. It's capturing a piece of film like this. The

19 top right corner of this image appears to contain white boxes

20 of unknown problems. If we take a section of that white box

21 image as shown in red and we enlarge it and we subject it to a

22 vertical stretch and place it below the final image, so here on

23 the right, you can see from the areas highlighted in blue that

24 the pattern of bands matches exactly between the two images.

25   In addition, the series of smudges above and below the

1 │ bands and the background noise is also a match.

2 │   And so from this, I conclude that the white box image on

3 │ the left is the digital source for the final published image.

4 │   **MR. TYLER:** Ms. Cornich, if we can go to the next

5 │ slide.

6 │   **THE WITNESS:** This is essentially showing the ORI

7 │ droplet overlay.

8 │   So, as was mentioned previously, when they overlay, it was

9 │ in black. On this particular slide red happens to be the color

10 │ where overlay is indicated. As I mentioned, it just depends on

11 │ what default gradient match you have installed in Photoshop

12 │ determines what those eventual colors are, but the end result

13 │ is the same which is that these two images overlap including

14 │ not only the bands, but also the noise above and below the

15 │ bands.

16 │ **BY MR. TYLER:**

17 │ **Q.**   Dr. Brookes, I probably should have picked up on this

18 │ earlier, but is this example actually the one we went through

19 │ in that Exhibit-51 earlier?

20 │ **A.**   Correct. Correct. This is the same example.

21 │   **MR. TYLER:** Ms. Cornich, if we can go to the next

22 │ page.

23 │ **BY MR. TYLER:**

24 │ **Q.**   Dr. Brookes, can you tell us what kind of comparison you

25 │ are doing here?

1   **A.**   Okay.   So on the right is the white box image that you saw

2   previously.   You'll note the file name with the minus 11 up at

3   the very top right.   On the left is a related image from this

4   family of images.   This is the raw image.   A number of features

5   about this document.   First of all, you will see in the file

6   name it's missing the number 11.   But, otherwise, the file name

7   is identical.   In addition, as shown, this image appears to

8   have a lot of commonalities with the white box image in the

9   areas outside of the white boxes, so essentially you can look

10 at anywhere outside the white boxes on the left image and you

11 will find the corresponding area in the right image.   The

12 images are essentially identical, all apart from the area in

13 the white box.

14   In terms of where this image came from, the image on the

15 left as shown in red, it appears to have rotational symmetry,

16 as well as vertical symmetry as shown in blue.   So what does

17 that mean?   So, in theory, we could fit eight Western blots on

18 a single piece of film.   However, that's a lot of work, so

19 quite often we do two Western blots.   And so this is thought to

20 be an image with two Western blots and so, for example, you

21 will expose the film for ten seconds, turn the gel around,

22 expose it for 30 seconds, turn the gel around, expose it for a

23 minute, flip it around and expose it for two minutes.

24   So you can capture four different exposures of the same

25 pair of membranes on a single piece of film.   And as you can

1 see, that results in slight differences in darkness for the

2 different exposures.

3   So it's a bit of a mental loop, but if you look over in

4 the top left corner, there is a membrane and then in the bottom

5 right corner is the same membrane. Those are the same

6 membrane, just two different exposures, and you will see one of

7 them is -- the one in the top left is slightly darker than the

8 one in the top right.

9   So this is essentially four different exposures of the

10 same two membranes. So because of all the commonalities

11 between the raw image and the white box image in terms of

12 everything outside the area of the white box, it is concluded

13 that this raw image is the source digitally for the white box

14 image.

15 **Q.**   Would you expect to see any markers on the raw image?

16 **A.**   Yes.   That is an unusual features of this image. In the

17 final published image, there are pH markers for isoelectric

18 point. Those are used to calibrate and essentially say

19 something about the conformation and the isoelectric point.

20   However, neither the white box nor the raw image appear to

21 have any pH markers. There are no annotations handwritten on

22 the membrane or the piece of film, so it's difficult to see

23 where those markers in the final figure originated from.

24 **Q.**   Is that something you have seen, in your experience?

25 **A.**   No.   That's highly unusual. That is not common standard

1 scientific practice. You annotated your gel so you have, as

2 was mentioned, a chain of provenance for the scientific data.

3   **MR. TYLER:** Ms. Cornich, if we can go to the next

4 page.

5 **BY MR. TYLER:**

6 **Q.** Dr. Brookes, can you tell us what we are looking at on

7 this page?

8 **A.** So this is now honing in on the top right corner of each

9 of those images. The image on the right is the white box. The

10 image on the left is the raw. And as you can see from the area

11 highlighted in red, the noise pattern is reproduced from left

12 to right. As you see in --

13 **Q.** Sorry.

14 **A.** As you see in -- from left to right between the raw image

15 and the white box image, the area in red is essentially

16 identical. The noise pattern, the fingerprint of noise from

17 the piece of film is transferred perfectly to the white box

18 image. However, if you look at the position in the white box

19 image where the bands appear which is in blue, there are no

20 corresponding bands in the left-hand image.

21   **MR. TYLER:** Now, Ms. Cornich, if we can go to the

22 next slide.

23 **BY MR. TYLER:**

24 **Q.** Dr. Brookes, if you can tell us what we are looking at,

25 what analysis you did here?

1 **A.**   So this is the forward analysis that was mentioned in this

2 experiment, and essentially attempting to manipulate the raw

3 image using fair and standardized methods that are accepted in

4 the field.   That is adjusting the brightness and contrast of

5 the whole image evenly.   An entire series of brightness and

6 contrast adjustment were made.   This just shows one example.

7 We don't have room to go through every one percent step of

8 both.

9   So what I was hypothesizing here is that perhaps there are

10 bands hidden in the raw image and that I might be able to

11 adjust the raw image in such a way as to make the bands in the

12 white box image appear.

13   What is apparent from what you see in red is that, yes,

14 indeed, some of the noise surrounding the bands, the dot in the

15 middle, the smudge over in the far right, some of the noise

16 does, indeed, appear to transpose from the white -- from the

17 raw to the white box image.   However, no adjustment that I

18 was -- that I performed was capable of making the bands in the

19 white box image come in to appearance.

20 **Q.**   And what does that show about the ability to recreate the

21 bands in the white box image from the raw image?

22 **A.**   So the fact that the noise transposes proves the digital

23 provenance here.   The white box image is a digital child of the

24 raw image.   However, the bands don't have prominence in the raw

25 image.

1 **Q.**   The image on the left, is that an appropriate

2 representation then of the raw image?

3 **A.**   That is an adjustment of the raw image, so anybody who

4 opened this in PowerPoint would be able to take that raw image

5 and adjust the brightness and contrast back to zero and arrive

6 back at the raw image so, yes, the image on the left does

7 represent the raw data, albeit with the brightness and the

8 contrast adjusted.

9 **Q.**   And in your view and experience, is that publishable data?

10 **A.**   The data on the left, in my opinion, is not publishable

11 because it does not appear to contain usable bands. And, in

12 particular, if we go -- if we count across four lanes. If we

13 go one, two, three, four or five. If we look in lanes four and

14 five, there do not appear to be any bands at all. There are

15 some smears and smudges. However, in lanes four and five of

16 the final published image, there are prominent sharp bands and

17 it's impossible to tell where they came from.

18   **MR. TYLER:** Ms. Cornich, if we can go to the next

19 slide, please.

20 **BY MR. TYLER:**

21 **Q.**   Dr. Brookes, can you tell us what we see here?

22 **A.**   This is just essentially the same as you saw on the

23 previous slide, just using gradient maps to illustrate the same

24 point. So, for example, if we -- the red boxes on the previous

25 slide, they appear black in this example.

1   So, if we look at the right hand red box in each case, you

2 can see the sort of little pattern of noise that looks like New

3 Zealand with some islands off the shore, that is a unique

4 imprint of this image, that noise being the same is a traceable

5 fingerprint between these two images that indicates that they

6 are digital relatives. So this is essentially just another way

7 of showing the same point.

8 **Q.**   Did you consider other possible explanations for what was

9 going on here?

10 **A.**   Yes. Other things such as stripping and reprobing. We

11 also considered the possibility that there may be additional

12 images that exist in between the raw image and the white box

13 image. However, that does not change the fact that the raw

14 image and the white box image are digitally related.

15   So, regardless of how many steps were involved in between

16 the raw image and the white box image, it still would not

17 explain where the bands came from in the light box image

18 because they were not there in the raw image.

19   **MR. TYLER:** Ms. Cornich, will you go to the next

20 slide.

21 **BY MR. TYLER:**

22 **Q.**   Now, Dr. Brookes, could you tell us what analysis you are

23 doing here on this slide?

24 **A.**   Yes. So I apologize. This is going to get a bit

25 technical. So over on the right, we have the published image.

1 That is the isoelectric focusing. The pH scale runs from 3.5

2 to 9.5. As I mentioned, when you run an isoelectric focusing

3 gel, the gel occupies the entire -- the pH gradient occupies

4 the entire height of the gel.

5   So, when you do an IEF gel, the top of the gel is ten.

6 The bottom of the gel is three. That is an incontrovertible

7 scale. You can't do anything about that. So, remember, the

8 bottom of the gel is three.

9   If we go over to the white box image, you can see we have

10 taken the whole of the gel, the full height of the gel in the

11 blue box. And if I subject that blue box gel to a vertical

12 stretching, in order to make the bands line up, so the bands

13 here line up, you can see, in fact, that the blue gel scaled,

14 if it were real, would cover much more than three to ten. In

15 fact, it looks like it would go all the way down to pH zero

16 which is physically impossible. It may even go to pH minus

17 one. There is no such thing as a negative pH.

18   So, based on this, I conclude that the stated pH range

19 here is physically impossible. Three to ten cannot had been

20 the original values on this full scale height of this blog

21 shown in the white box image.

22   So this particular pH scale is not only do we not know

23 where it came from, but it's also impossible given the relative

24 scaling of these things and the vertical stretching that has

25 occurred.

1 **Q.**   Where would you expect to see that or that scale, that pH

2 scale on the white box image?

3 **A.**   I would expect to see some markers on the white box image

4 or on the raw image if they show up in the final published

5 image.

6 **Q.**   And, in your experience, is there -- are there other ways

7 that you can transfer that information?

8 **A.**   If you wanted to, you could type that or you could try to

9 note it down in a book or have the film stuck to a piece of

10 paper, but then you -- you know, any time you are not keeping

11 the data together all in one place, that risks mistakes, that

12 risks sloppy lab practices.

13   So, for example, here everything is in one piece of paper.

14 This piece of film contains the data, contains the molecular

15 weight markers. If that gets run over by a car, the data is

16 still there. We are not going to lose any of that data.

17 Whereas, if it was kept in a separate place, if the molecular

18 weight markers or the pH markers were in a different place, in

19 different file, in a different folder that creates the

20 likelihood of mistakes further down the road.

21   So the scientifically correct way to do this is to keep

22 all of the information in one place together.

23   **MR. TYLER:**   Ms. Cornich, now if we could turn to

24 Exhibit-10B.

25 **BY MR. TYLER:**

1 **Q.**   Dr. Brookes, can you tell us what this document is?

2 **A.**   So this is a PowerPoint file that was provided by Agent

3 Weeks. On the first page of the PowerPoint file is what

4 appears to be the figure for the paper. It's quite common to

5 take a Western blot image, import it in to PowerPoint and then

6 apply the various annotations as you see here. The scale, the

7 labels in a software such as Microsoft PowerPoint.

8   **MR. TYLER:** If we can go to the second slide.

9 **BY MR. TYLER:**

10 **Q.**   Dr. Brookes, did you discover anything about this slide?

11 **A.**   So this slide contains the graph, as you see from the

12 paper and the grant. These appear to be the same data.

13 Everything about it is the same including, for example, the

14 minute positioning of the stars used to indicate significance

15 so that this does appear to be the figure. If we right click

16 on this figure, we can go to chart object, and we can select

17 open and that will actually export a marker off the Excel file.

18   And so there are several ways to get a graph from

19 Microsoft Excel in to PowerPoint. However, when that is done

20 directly by just dragging it into PowerPoint, all of the Excel

21 file and the data used to plot the graph comes along for the

22 ride. So you can see in this Excel file which was just

23 generated de novo right here in this courtroom from the

24 PowerPoint, if we go to sheet one, this is, if we scroll up,

25 this is the data that was used to generate that chart that

1 appears in the grant and the paper.

2   **MR. TYLER:** Ms. Cornich, if we can now pull up

3 Exhibit-10C.

4 **BY MR. TYLER:**

5 **Q.** Dr. Brookes, can you tell us what this is and what its

6 relationship is to the Excel sheet we were just looking at?

7 **A.** Yes. So, over on the left you will see PI 5.9 and 5.2 or

8 maybe it's a 5.3. It is not clear. There are two different

9 values there. The area in yellow --

10 **Q.** I'm sorry, Dr. Brookes, to interrupt you. What is this in

11 comparison to the last spreadsheet and what is it says --

12   **THE COURT:** Can I ask, is this a slide that's in

13 Exhibit-10B, or is it something else?

14   **MR. TYLER:** It is -- Your Honor, this 10C is an

15 annotated version of the one that we just extracted.

16   **THE COURT:** I guess I'm not seeing a Bates number or

17 anything like that, so I don't even know if this is part of

18 what you just offered as 10B.

19   **MR. TYLER:** So 10B is a PowerPoint with the embedded

20 Excel sheet and 10C is that same Excel sheet annotated by Dr.

21 Brookes.

22   **THE COURT:** So, when you say it was embedded, it's

23 electronically embedded, but the physical document, in theory,

24 is a piece of paper, so this is some sort of native file?

25   **MR. TYLER:** Correct.

1   **THE COURT:** Okay. I mean, I think just so you know

2 where we are going to have to have this in a format where we

3 know what we are looking at. This may or may not be easily

4 replicable in the record somehow in the future, so you are

5 going to need to have screens of this, not just pulling things

6 up off your computer which can be changed.

7   **MS. BEIDEL:** Your Honor, in addition to that concern,

8 I haven't heard a tie in to Western blotting methods at all and

9 in the interest of time today, I'm not sure -- I feel like we

10 are down a rabbit trail at this point talking about pH data.

11   **THE COURT:** I mean, there are things in the expert

12 reports about this. There wasn't a whole lot of detail in the

13 report, but I think this issue came up, I think. So why don't

14 we go a little further and see where it goes.

15   **MR. TYLER:** Yes, Your Honor.

16 BY MR. TYLER:

17 **Q.** Dr. Brookes, could you just walk us through this annotated

18 version of that spreadsheet?

19 **A.** Yes. So over on the left in Column A we have the labels

20 of the different isoelectric points. 5.9 and 5.2. The numbers

21 over to the right are densitometry values. So these are values

22 purporting to represent the density of the bands in each of the

23 samples. There appear to be six sets of data so, for example,

24 rows eight and nine those are one set of data. Row 12 and 13,

25 that is a second set of data. So there are six sets of data.

1 These are highlighted in yellow. I should note that is not my

2 highlight. The spreadsheet came like this, so this set of data

3 highlighted in yellow is what was used in the presentation.

4   As you will see in cell number C9, there is a five. That

5 is not particularly unusual. However, a cross in cell number

6 E9 and G9, and then down in number 13, you will see there are a

7 number of other fives, and then further down there are tens.

8   It is very unusual that the number five and ten appears

9 with this frequency in stochastically acquired biological data.

10 There does not appear to be an explanation for this. The

11 simple one would be, oh, maybe this is a rounding error. Maybe

12 everything gets rounded to the nearest five or zero.

13   However, the other numbers in the spreadsheet do not all

14 end in five and zero, so that does not appear to be a

15 reasonable explanation for why.

16   Secondly, for reasons that I really don't understand,

17 there is a set of six independent experiments in the central

18 yellow part of the sheet. If we could scroll up please to row

19 eight and nine, you will see the values -- the first value

20 1542. Reading across 1627. If we scroll down now, for some

21 unexplained reason that same first set of data appears three

22 more times in the spreadsheet.

23   Typically, a scientist, when we are trying to keep track

24 of things, it's bad enough trying to keep track of things, but

25 having three extra versions of one of the independent

1 experiments inexplicably included in the sheet for no apparent

2 reason, that appears to be, again, just not following standard

3 practices. Very very unusual.

4   Scrolling down further to the third, what has happened

5 here in red and the numbers below in red is the size of those

6 little T arrow bars is being calculated. So, if you click on

7 some of D47, what's being calculated here is the average

8 density of the six samples. And then in the cell below in D48,

9 we are calculating the size of that arrow bar.

10   Now, the typical mathematical formula that is used to

11 calculate that and the formula is written in the formula bar in

12 Excel right here -- the typical formula is to take the standard

13 deviation of the numbers and divide it by the square root of

14 the number of samples, so if the --

15   **MS. BEIDEL:** Objection.

16   **THE COURT:** What's the objection?

17   **MS. BEIDEL:** There's no methodology for this type of

18 analysis in the report. He has a methodology that is a

19 three-step analysis of Western blot images. Now he's telling

20 us about typical scientific methods for all kinds of things.

21   **THE COURT:** I agree these are issues, and I think for

22 purposes of this hearing only, I think we should handle that

23 through cross-examination first. And then if you want to try

24 to exclude something at that point, we can. Obviously, we are

25 handling this differently than we would at trial, but let's

1   handle it that way.

2   **MS. BEIDEL:** Understood, Your Honor. Thank you.

3   **THE COURT:**   Thank you.

4   **BY MR. TYLER:**

5   **Q.**   Please proceed.

6   **A.**   So, the typical formula -- in fact, the formula for the

7   calculation of the standard error of the mean is to take the

8   standard deviation and divide it by the square root of N, so

9   this would be the square root of six. For an inexplicable

10 reason here, the error bar has been calculated when multiplying

11 the standard deviation by five. Further over, on comment

12 number four, it's very similar and related. Again, instead of

13 dividing the error by a number, they multiplied the error by a

14 number to calculate the error bar. That is just not the way

15 that errors are calculated.

16   The wrong formula has been used to calculate errors.

17 However, what is notable is that in every case the result is

18 that the error bars appear larger than would be typical.

19   So I have calculated, again, one of the errors here in

20 cell number Q48 using the correct formula. And what you see by

21 comparison with the number above, the number above is

22 70 percent, plus or minus two percent. Two percent is the

23 correct error. This is how it should had been calculated in

24 the spreadsheet. Instead, the error that is reported in the

25 graph is 9.7 percent over on the left in cell number O48.

1   Generally speaking, biological processes are noisy. Every

2 time we transfer liquid, we are patting. Everything is

3 calibrated, but there is noise. I would say on a good day it

4 is very good to get anything less than a ten percent error on a

5 biological experiment. A two percent error, on the other hand,

6 would attract scrutiny from reviewers as being too small. A

7 two percent error would raise eyebrows --

8   **MS. BEIDEL:** Objection. Speculation.

9   **THE WITNESS:** -- in the field.

10   **THE COURT:** So, again, we will handle this on

11 cross-examination I think to start with. But can I just --

12 again, Mr. Tyler, it's kind of confusing. I thought that what

13 we had here was a PowerPoint that was perhaps created by

14 Dr. Wang with a spreadsheet. Now I'm looking at a screen where

15 there is all types of annotations by Dr. Brookes.

16   So what is this? This isn't evidence, is it?

17   **MR. TYLER:** No. This is demonstrative to --

18   **THE COURT:** We need to have numbers and understand

19 exactly what we are looking at here because if this happened in

20 front of the jury, I would be probably excluding it entirely

21 because you purported it to be actual evidence and now it's

22 just work product by the expert which are two totally different

23 things.

24   **MR. TYLER:** Understood, Your Honor.

25   **THE COURT:** Can I just understand, is this

 1 spreadsheet something that supposedly was in the raw

 2 information obtained from Dr. Wang?

 3   **MR. TYLER:** Yes, Your Honor.

 4   **THE COURT:** And, then, these annotations were added

 5 later for some unknown reason?

 6   **MR. TYLER:** The annotations were added later as

 7 analysis, Your Honor.

 8   **THE COURT:** Then why didn't you say that when you

 9 offered it? You said this was the data.

10   **MR. TYLER:** I'm sorry, Your Honor. When we switched

11 from 10B to 10C, I included --

12   **THE COURT:** When we switched to 10C, just this

13 spreadsheet or the PowerPoint?

14   **MR. TYLER:** 10C is the spreadsheet annotated by Dr.

15 Brookes. 10B is the spreadsheet that is derivative from

16 Dr. Wang's PowerPoint.

17   **THE COURT:** How are they different? Just the

18 annotations?

19   **MR. TYLER:** Just the annotations and this calculation

20 that is PSB5 he's pointing to.

21   **MS. BEIDEL:** Again, Your Honor, I believe this

22 annotated version to have only been produced in connection with

23 this hearing or just this week produced so, again, we have a

24 disclosure problem with respect to this, unless it's --

25   **THE COURT:** Has the defense seen this before?

1   **MS. BEIDEL:** It's not Bates labeled in the --

2   **MR. TYLER:** This has been disclosed before, Your

3   Honor.

4   **MS. BEIDEL:** How recently, Your Honor?

5   **MR. TYLER:** This was disclosed as part of the

6   original production.

7   **THE COURT:** The spreadsheet?

8   **MR. TYLER:** Yes.

9   **THE COURT:** With all the annotations, the bizarrely

10   comments and the like?

11   **MR. TYLER:** Yes, Your Honor.

12   **THE COURT:** Okay.

13   **MS. BEIDEL:** With respect to Dr. Brookes' material,

14   something we have been asking the government to do for months

15   now is to give us an organized version of an understanding of

16   what Dr. Brookes' report is. There are all these materials

17   strewn throughout the two million pages of discovery materials

18   that we can't possibly find everything. We have a right to

19   have an understanding of what the government's conception of

20   the report is.

21   **THE COURT:** We can certainly have this discussion

22   later without taking up Dr. Brookes' time. So why don't we

23   finish with the testimony? We will certainly have that

24   discussion.

25   **MS. BEIDEL:** Thank you.

1   **MR. TYLER:** Thank you, Your Honor.

2 **BY MR. TYLER:**

3 **Q.**   Dr. Brookes, if you could just do the last two comments

4 here?

5 **A.**   So, scrolling over to the left, and scrolling up a bit and

6 over to the left, essentially what was done after the data were

7 calculated, so in the upper set of red and blue bars of the

8 calculations of the average data from the six experiments.

9   Now, sometimes it's necessary to move those cells around

10 in order to then plot the data in a graph. And so the numbers

11 in red in the top set of bars were copied and pasted or moved

12 somehow to give rise to the set of numbers in the red set of

13 bars. And the data in this lower set of bars here in red and

14 blue, that is what was used to plot the graph that you see in

15 the grant.

16   What's unusual here is that while all the numbers in red

17 and blue appear to track properly, so, for example, 0.994 in

18 cell number D47 becomes 99.4 percent in cell number D56. So,

19 everything in red and blue tracks properly, so there is a

20 process by which the data that was calculated has been

21 transposed into a format that makes it easier to select for

22 plotting the graph.

23   However, the numbers in orange have not transposed and, in

24 fact, for example, if we look at cell number M51, that is a

25 1.6 percent error. If we now look at cell I60, that is a

1 four percent error. That number four and the three next to it

2 and the 99.7 above it in orange, those numbers appear to have

3 just come from nowhere. They do not have any provenance

4 elsewhere, unlike all of the blue and red numbers all of which

5 can be traced to the upper set of blue and red numbers which

6 can, in turn, be traced to the rest of the data file.

7   So the numbers here that were used to generate those T

8 bars, those error bars in the final graph, these are the

9 numbers and they don't have any provenance anywhere else in

10 this spreadsheet. That three and four appear to me to have

11 been fabricated.

12 **Q.**   Dr. Brookes, would you expect to see a formula in that bar

13 on the top, is that related to what your conclusion there?

14 **A.**   Yes. Yes. I would expect if that cell is related to

15 another cell I would expect to see a formula telling us how

16 they are related.

17   **MR. TYLER:** Ms. Cornich, if we can go to the left all

18 the way and cover the last.

19   **THE WITNESS:** So the last point turns to the

20 feasibility of some of these numbers. When we express the

21 average plus or minus an error bar, that error bar is

22 essentially expressing the range of possible values of the data

23 that contributed to that average.

24   And so, for example, here if we look in cell number D57,

25 we have a value of 99.4. The range is giving in D60 which is

1 2.5. So the way we express this scientifically is 99.4, plus

2 or minus 2.5. The fact of the -- if you take 99.4 and you add

3 2.5, you get a number that is bigger than a hundred. That

4 means that some of the numbers that contributed to that 99.4

5 average must have been bigger than a hundred percent. And that

6 is physiologically impossible. You can't have more than a

7 hundred percent of a protein in a particular confirmation.

8   So, again, the error bars relative to the actual numbers

9 are physically impossible.

10 **Q.**   Thank you, Dr. Brookes.

11   **MR. TYLER:** Just to close a loop here, Ms. Cornich,

12 can you bring up Exhibit-10, Page 4.

13 **BY MR. TYLER:**

14 **Q.**   Dr. Brookes, could you just tell us what we're looking at

15 here?

16 **A.**   So this is the text description in the report describing

17 the PowerPoint file, where the numbers came from, the

18 extraction of -- so this is describing in text the process by

19 which the PowerPoint file was extracted and then a summary of

20 the annotations in the XL file that were just discussed.

21 **Q.**   So that's a narrative of what we --

22 **A.**   That's a narrative of what we just discussed, yes.

23   **THE COURT:** Give me the number on this again, please.

24   **MR. TYLER:** It's Exhibit-10, Page 4. If we go to the

25 bottom, I can give you the Bates number. The last six of the

1 Bates are 352197.

2   **THE COURT:** So this is the expert report on 4.7?

3   **MR. TYLER:** That's correct, Your Honor.

4   **THE COURT:** That we already have. Thank you.

5 **BY MR. TYLER:**

6 **Q.**   Dr. Brookes, taking on the analysis together with respect

7 to figure one, what did you conclude with respect to the

8 research record here?

9 **A.**   So I conclude on the basis of this analysis that the bands

10 that appear in the final published image and in the white box

11 image find absolutely no provenance in the raw data. In

12 addition, the graph -- the error bars in the graph in

13 particular, appear to have been fabricated and, therefore, I

14 concluded the result as it is presented in the published grant

15 and paper does not represent the scientific record.

16   **MR. TYLER:** Your Honor, this is a little bit of a

17 stopping point. I don't know if the court reporter needs a

18 five-minute break. We are happy to keep going.

19   **THE COURT:** How much longer do you have with this

20 witness?

21   **MR. TYLER:** As we have it set up, about 45 minutes.

22   **THE COURT:** Why don't we take a break then. We'll

23 take a ten-minute break and we'll come back. Just again to --

24 hold on a second. We will take a ten-minute break. We will

25 come back and finish, at least the direct with Dr. Brookes, and

 1 then we will see where we are.

 2   **MR. TYLER:** Thank you, Your Honor.

 3   **DEPUTY CLERK:** All rise. This Honorable Court now

 4 stands in recess.

 5   (Whereupon, a recess was taken from 10:48 until 11:00

 6 a.m.)

 7   **DEPUTY CLERK:** All rise. This Honorable Court

 8 resumes in session. The Honorable Theodore D. Chuang

 9 presiding.

10   **THE COURT:** Thank you, everyone. Please be seated.

11   Go ahead. Continue.

12   **MR. TYLER:** Thank you, Your Honor.

13 **BY MR. TYLER:**

14 **Q.**   Now, Dr. Brookes, turning to some vignettes in the other

15 reports without going through each ad nauseam. Let's turn to

16 Exhibit-5A for a minute.

17   Dr. Brookes, can you tell us which report you see on your

18 screen there?

19 **A.**   This is report number 4.2 regarding series of images from

20 figure two of a grant proposal.

21   **MR. TYLER:** Ms. Cornich, if we can go to the next

22 page, please.

23 **BY MR. TYLER:**

24 **Q.**   Dr. Brookes, can you tell me what is the analysis that you

25 have done here?

1 **A.**   So this is a reverse analysis tracing the final published

2 image that you see in the top right corner. It's a series of

3 two Western blots side by side tracing that to a white box

4 image. You will notice the final published image over on the

5 right has 20H7. That is the name of an antibody that was used

6 in this Western blot.

7   In addition, you will see the title of the white box image

8 contains the same text and, in fact, the handwriting in the top

9 left corner of the piece of film also says 20H7. The file name

10 of the white box image also contains a number 11 like many of

11 the other images. The Western blots themselves are reporting

12 levels of protein in various different patient samples. AC

13 here is Alzheimer's Disease. YCI is young cognitively

14 impaired, so these are patients of different stages of the

15 Alzheimer's process.

16   In the image on the left, we have highlighted the red

17 zone. The white box and enlarged that and moved it down here

18 below the main image, and as you can see from the areas

19 highlighted in blue, the pattern of bands is reproduced between

20 the white box image and the final published image which leads

21 to the conclusion that the white box image was the source. In

22 addition to the bands themselves, you can see a number of noise

23 features, most prominently this large vertical smudge below on

24 the AD band is reproduced as well.

25 **Q.**   And, Dr. Brookes, can you see any molecular weight markers

1 in the white box image?

2 **A.**   No.   Despite the appearance of molecular weight markers on

3 the left in the final published image, there don't appear to be

4 any molecular weight markers on the white box image.

5 **Q.**   If we can go to the next page after you sort of made this

6 match.   What are we looking at here?

7 **A.**   This is essentially the ORI droplet applied to the

8 left-hand set of blots and on the left slide is the same

9 analysis applied to the right-hand set of blots.

10   **MR. TYLER:**   Ms. Cornich, if we can go to the next

11 page.

12 **BY MR. TYLER:**

13 **Q.**   Dr. Brookes, what do we see here?

14 **A.**   So this on the right is the white box image, as you just

15 saw in the previous slides.   On the left is a related raw

16 image.   You will note the raw image is missing the number 11

17 from the file name.   However, a number of other features are

18 common between the raw image and the white box image.   The

19 handwriting 20H7 in the top left corner, as well as all the

20 noise features that are shown in red here are common.   The

21 right-hand image has been rotated slightly.   It's at a slightly

22 different angle, but, nevertheless, the noise pattern is

23 reproduced and so this leads to the conclusion that the raw

24 image shown here is the digital source for the white box image.

25 **Q.**   If you go to the next page.   Dr. Brookes, can you tell us

1 what analysis you are doing here on this page?

2 **A.**   So this is a forwards analysis. This is, as was

3 described, at the top is the raw image. At the bottom is the

4 white box image, the relevant parts of both. In the middle is

5 where I have taken the raw image and subjected it to a

6 brightness adjustment in order to see if the bands in the white

7 box image appear. What you can see in red, the reason why this

8 particular 80 percent brightness was chosen is because this was

9 the adjustment level that lead to the appearance of the noise

10 that is in the red box.

11   So you see in the two red boxes here that the noise in the

12 adjusted image and the white box image are identical, so

13 certainly the noise in the white box image appears to come from

14 the raw image. However, if you look at the areas highlighted

15 in blue, you can see that the bands in the white box image do

16 not appear in the raw image or in the adjusted version of the

17 raw image.

18 **Q.**   When you did that adjustment, were you at any point able

19 to make those bands appear?

20 **A.**   What is shown here is an 80 percent brightness, but I

21 attempted any and all combinations of brightness and contrast.

22 No adjustment was performed which was able to reproduce and

23 cause these bands in the white box image to appear.

24 **Q.**   What conclusion were you able to draw by the fact that the

25 red boxes match?

1 **A.**   The red boxes matching essentially says these two images

2 are digital relatives, that one is the source for the other

3 because the fingerprint of that noise is reproduced between

4 them, and that is also seen in other parts of the image such as

5 the handwriting in the top corner of both images.

6 **Q.**   Thank you. Let's move to maybe quickly through another

7 example of this. If we could bring up Exhibit-7A.

8   Dr. Brookes, what report is this?

9 **A.**   This is report number four dealing with figure four from

10 one of the N.I.H. grant proposals.

11   **MR. TYLER:** And if we can go to the next slide, Ms.

12 Cornich.

13 **BY MR. TYLER:**

14 **Q.**   Dr. Brookes, did you, generally speaking, explain what the

15 red arrows here are indicating?

16 **A.**   Yeah. My apologize for the number of arrows on this

17 slide. The final published image is in the center on the

18 right-hand side of the slide. So this here is the final

19 published image. On the left is the corresponding white box

20 image. You will note, again, number 11 in the file name. The

21 upper portion of this white box image in the top left, that is

22 highlighted in red and then shown expanded and enlarged below

23 the final published image, so you can see from the matching

24 blue boxes here and here that this image is the source for

25 those particular bands in the final published image and then

1 flipping things around, the bottom left, if we take the bottom

2 left white box image that's highlighted in red, we take that

3 and blow it up and put it above the final finished image, you

4 can see that the other bands highlighted in blue here and here

5 are also matching.

6   So this particular white box image which has a number of

7 white boxes on it is the digital source for this final

8 published image. And you can see a number of noise features as

9 well. For example, this smudge here is reproduced in the final

10 image as well.

11 **Q.**   And did you also do the droplets overlay analysis on this?

12 **A.**   Yes. That was performed on this analysis as well and

13 showed the same conclusions.

14 **Q.**   I think we can skip through and go to Page 5 of this or

15 Page 6. I apologize.

16   So, Dr. Brookes, after having done that analysis, what are

17 we looking at here?

18 **A.**   So this is, again, a forwards analysis. On the top is the

19 raw image. On the bottom is the white box image trying to test

20 the hypothesis that the raw image can be adjusted in a way that

21 makes the bands in the white box image appear. Again, as you

22 see in red here and here, there are a number of noise features

23 and background features which do appear to transpose from the

24 raw image to the white box image. Notably, there are, in fact,

25 a pair of bands which match up to a pair of bands on the raw

1 image and they, indeed, show up in the white box image.

2 However, as you can see, nothing in blue is in common between

3 these images. No adjustment of any kind was able to make the

4 bands appearing in blue in the final image appear.

5 **Q.**   Taking all that together, what were you able to conclude

6 about the relationship between these images?

7 **A.**   So they are digitally related. The raw image appears to

8 be the parent of the white box image and the bands in the white

9 box image, however, don't have any provenance in the raw image.

10 **Q.**   Is that true regardless of what different types of

11 contrast and brightness adjustments you did?

12 **A.**   Correct. Any and all adjustments failed to yield the

13 bands in blue.

14 **Q.**   Let's now move to Exhibit-11A. Dr. Brookes, can you tell

15 us what figure this relates to?

16 **A.**   This is report number eight regarding figure seven from

17 the N.I.H. proposal.

18 **Q.**   And then if we could fast forward to I guess page -- the

19 next page here.

20   Dr. Brookes, can you tell us what we see here?

21 **A.**   So this is a series of Western blots for one, two, three,

22 four, five, six, seven different proteins across a number of

23 different conditions. The proteins are listed on the right.

24 PLC1 and NOS-PYK, PSD95. Over on the left are the purported

25 molecular weights of those proteins. Down at the bottom is a

1 Western blot for a protein called NR1. In this case, that

2 protein is being used as a control. Fairly often when doing

3 Western blotting of a number of different proteins we Western

4 blot what is called a housekeeping protein or a protein that is

5 very common in cells as a way of ensuring the same amount of

6 protein has been loaded in each lane.

7   So it's fairly common when we want to quantify, for

8 example, the amount of PSD95 or PKC, we would express the

9 density of those bands relative to the density of the NR1 band

10 as a way of normalizing that density to the amount of protein

11 that is loaded in that particular lane.

12 **Q.**   Looking at the third and fourth rows there, could you just

13 identify for us what molecular weight we are looking at for

14 those two proteins?

15 **A.**   Yes. So on the top is a protein called PYK2. That has a

16 native molecular weight of about 114 kilodaltons, so as you can

17 see, it runs ever so slightly above the 100-molecular weight

18 marker. In addition, PSD95, as the name suggests, has a

19 molecular weight of 95 kilodaltons, and so that runs ever so

20 slightly below the 100-molecular weight mark.

21   I found it surprising that it was possible to blot the two

22 of these on the same gel because, in fact, they are barely

23 separated. One is right above one of the markers and one is

24 right below it.

25   So, if you were to run these on the same gel, they would,

1 in fact, appear very very close together, almost overlapping.

2 **Q.**   If we could go to the next page. Dr. Brookes, could you

3 just walk through what we're looking at here and what analysis

4 you did?

5 **A.**   So these are the white box images which corresponds to the

6 published image that you just saw. Drawing your attention over

7 to the right, this is the Western blot in which PYK and PSD95

8 were run on the same gel. What is surprising about this is the

9 degree of vertical separation between the bands. You know,

10 there is not a lot of different between 114 and 95. And as I

11 mentioned, you typically want to run those on separate blots.

12 So the fact that they both appear on this single separated by a

13 very very large amount does not seem feasible or physically

14 possible for those bands to be real.

15 **Q.**   In terms of the numbers that are counted out, what is the

16 relevance of those?

17 **A.**   Yes. So, as I mentioned, when you want to quantify the

18 data from this type of blot, it's typical to normalize it to

19 the amount of NR1. So, if you look at the two gels on the

20 right and count the lanes from left to right, you can see that

21 they both have 13 lanes. However, if you look at the NR1 blot

22 over on the left, you can see that because it's handwritten NR1

23 control. There are only 12 lanes. So that means for at least

24 one of those samples it would be impossible to calculate the

25 density relative to NR1 because you only have 12 NR1 bands to

1 normalize 13 bands of the protein of interest.

2   Another interesting feature about these two blots on the

3 right, they are ten well gels. There are ten lanes. And as

4 you see here, all ten lanes have been used for loading of

5 biological samples. That does not leave any room for loading a

6 molecular weight marker and, in addition, there are no

7 molecular weight annotations anywhere on these Western blot

8 images which, again, makes it unusual that the final published

9 image has molecular weight markings alongside the blots.

10 **Q.**   Dr. Brookes, were you able to track down any data

11 associated with this particular image?

12 **A.**   Yes. We were able to locate a PowerPoint file and the

13 PowerPoint file contained a graph that was published alongside

14 these Western blots and right clicking on the graph was able to

15 bring up an Excel sheet and we were able to analyze the Excel

16 sheet.

17 **Q.**   And with respect to the 12 versus 13, did you notice

18 anything on that?

19 **A.**   What was unusual is that the NR1 data in that data set,

20 there were 13 possible conditions, even though there were only

21 12 bands, so there were 13 sets of data in the spreadsheet so

22 it's hard to see where at least one of those data sets came

23 from given that there were only 12 bands to base the

24 densitometry on.

25 **Q.**   Thank you. Moving ahead to the next example. If we can

1 go to Exhibit-12A.

2   Dr. Brookes, can you tell us which analysis we are looking

3 at here?

4 **A.**   This is report number nine looking at figure nine in the

5 N.I.H. grant.

6   **MR. TYLER:** If we could go to the next page, please

7 Ms. Cornich.

8 **BY MR. TYLER:**

9 **Q.**   If you could us what we're looking at here?

10 **A.**   So the top image is a white box image. It is a zoom in on

11 an area of a white box image and in red, I've highlighted a

12 series of six Western blot bands. Below in blue and orange is

13 a false color gradient map applied to that in order to

14 highlight the edges of those bands and their shape and size.

15   What's unusual about this, as you see underlined in red,

16 three of the bands appear very very similar shape, almost

17 identical. The other three bands highlighted in white also

18 have a very unique shape that is reproduced across all three

19 bands. It's quite common in a Western block, for example, to

20 see one band with a small indentation in it or a small smudge

21 on the right-hand side as you see here. It is highly unusual

22 to see several bands all of which appear to be identical, and

23 it's just completely unheard of to find sets of bands, families

24 of bands that appear to be reproduced.

25 **Q.**   Have you ever seen that happen in one of your blots?

1 **A.**   No.   That is not something I have ever seen in a normal

2 set of Western blots.

3 **Q.**   Could you explain what the bottom, each of the bottom two

4 figures are?

5 **A.**   So in gray, this is a forensic image analysis tool known

6 as error level analysis.   Essentially when a JPEG image is

7 created, if the parts of that image all have the same

8 provenance, then the error in that image should be evenly

9 distributed.   However, the ELA here, as you see in highlighted

10 by the red arrows, there appears to be a rectangular portion of

11 this image which has a different error level in the JPEG and

12 the rest of the image.   And that is highly suggestive that this

13 part of the image, in fact, came from somewhere else.   In fact,

14 we don't even need to do ELA image analysis to show this.   If

15 we look in green, this is just a gradient map applied to the

16 whole image in order to extenuate the background noise, and you

17 can see the, generally speaking, the whole of the background of

18 this gel image is green with yellow speckles.   However, the

19 area highlighted, the rectangle in green, has significantly

20 less yellow.   It appears to be on a different background than

21 the rest of the image.

22 **Q.**   Do you remember ever seeing anything like this in one of

23 your own blots?

24 **A.**   I have never seen this in any normal Western blot.

25 **Q.**   Now, let's turn to Exhibit-15A.

1   Dr. Brookes, can you tell us what we are looking at here?

2 **A.**   So this is a report looking at a number of different

3 images and grant proposals and tracing them back to single

4 source images.

5 **Q.**   Dr. Brookes, could you --

6   **MR. TYLER:** If you could go to the next page, Ms.

7 Cornich.

8   **THE WITNESS:** Okay. So in the top right, you see

9 figure four of one of the ROR44 grant applications. The

10 Western blot of interest in this case is highlighted in red.

11 That is a Western blot for the nitrotarazine form of tau. That

12 is what NY stands for.

13   Over on the left is a related white box image. You will

14 note like all of the other white box images, it has 11 at the

15 end of the title. In the top left is a white box area from

16 that blot. We have enlarged that in red and brought it down

17 underneath the enlargement of the NY tau blot from the figure.

18 You can see not only the density of the bands are the same,

19 they also have exactly the same relative position. Some are

20 slightly higher than others. In addition, the width of the

21 bands is the same. The left-hand band in particular appears

22 slightly narrower than the other bands, and then there is a

23 smudge to the upper left corner which is also reproduced.

24   So this, along with the ORI droplet analysis which I

25 believe is on the next page of this report, shows that these

1 images are, in fact, the same image.

2 **Q.**   And then if we go to the next page after that, what are we

3 looking at here?

4 **A.**   So in C in the top right this is figure 13 from a

5 different R01 -- sorry -- R44 grant proposal. This shows a

6 Western blot for the protein Beta Actin and below the bands you

7 can see a prominent pattern of smudging immediately below the

8 bands on the right.

9   On the left is a white box image. It appears to have a

10 similar file name to the other white box image. However, now

11 instead of 11 at the end, it has 1232 at the end. This white

12 box image has an area of the upper left blot that has been

13 taken in red and enlarged and moved below the published image.

14   And as you can see, the images are the same. The bands

15 are the same. The smudges above and below the bands are the

16 same. And that's also reproduced in the ORI droplet analysis

17 as well.

18 **Q.**   If we can go to the next slide, is this that droplet

19 analysis?

20 **A.**   Correct.

21 **Q.**   Now, let's go to the last slide. Dr. Brookes, if you

22 could explain what we can see now here between all three of

23 these figures?

24 **A.**   Okay. So on the right you see the two white box images

25 for the two completely separate proteins in completely

1 different figures. And you see on the left is the raw image.

2   What's unusual here is if we actually count up the bands

3 and we look at the figure legends from the figures reporting on

4 what are the treatments in each group, and so focusing on the

5 middle, if we look at the middle blot, if we count six bands

6 over from the left, we can see that the six band corresponds to

7 treatment of the sample with a thousand units of the drug.

8   So lane number six contains the sample that was treated

9 with a thousand units of drug. If you now go to the white box

10 image on the right and count over six bands to here, you can

11 see that that exact same lane in the exact same position of the

12 gel now corresponds to a hundred units of the drug.

13   You can't load more than one biological sample in the same

14 lane on a gel. So this reporting of what has apparently

15 happened in the samples of these drugs is impossible.

16 Q.   Taking also a step back, Dr. Brookes, is it possible for

17 the raw image to be the parent for both the figure four in the

18 middle and the figure 13 on the right?

19 A.   Yes. The raw image has the same handwriting, the same

20 fault, the same blotches. In addition, one particular

21 alternative explanation we thought about here was the

22 possibility for stripping and reprobing because we are looking

23 at two different Western blots for different proteins.

24 However, as mentioned, when you take a Western blot membrane

25 out and wash it and strip it and put another membrane and

1 another antibody and put it in a new file wallet, there are

2 different bubbles and different bits of hair and whatever gets

3 in there. It is impossible that the exact same pattern of

4 blotches and noise and bubbles and everything would appear on

5 all three. The only possibility here is that these images are

6 all digital relatives of each other.

7 **Q.**   And with respect to the raw image, can that have been the

8 source of the bands for figure four and then a different set of

9 bands for figure 13?

10 **A.**   The bands in the white box image do not find provenance in

11 the bands in the raw image. There are unusually -- unlike many

12 of the other raw images in this case, there are some bands in

13 this raw image. However, they do not match the bands in the

14 white box images or the published images in terms of the slope,

15 the shape, the size, the spacing, the distribution and the

16 density.

17 **Q.**   Let's now turn to Exhibit-8A. Dr. Brookes, can you tell

18 us what report we're looking at here?

19 **A.**   This is report five. This is looking at figure 14 from

20 the R44 proposal.

21   **MR. TYLER:** Ms. Cornich, can we go to the next page?

22 **BY MR. TYLER:**

23 **Q.**   What do we see here with this analysis?

24 **A.**   In the top right is the final published image. We are

25 looking at three different proteins, TLA -- TLR4, Filamin A and

1 the alpha 7 nicotinic acetylcholine receptor. Over on the left

2 is a white box image. You will note from the file name that

3 the three proteins that we just mentioned are listed in the

4 file name along with 112 appended to the end of the file name.

5   So, if we look at the white box image, we have highlighted

6 that in red and bring it down and put it below, the proteins

7 are in a different order than they are vertically, so in the

8 final published image Filamin A is at the bottom, whereas in

9 the white box image it's at the top. That does not really

10 matter. What is important is the bands match. Everything is

11 the -- the areas in blue, the bands in the white box image are

12 the bands in the final.

13   **MR. TYLER:** Ms. Cornich, if we can go to the next

14 slide.

15 **BY MR. TYLER:**

16 **Q.**   Dr. Brookes, now what do we see here?

17 **A.**   So this shows the corresponding raw image. At the top

18 that is the raw image. The white box image is in the middle.

19 You can tell that they're related by the handwriting on both

20 images as well as the file names minus the 112 part. And then

21 at the bottom we have a very unusual image which is part of the

22 same digital image family. It has the same handwriting. But

23 in this case there are very solid black bands and there does

24 not appear to be a white box.

25 **Q.**   Just to be clear, this is what you are talking about when

1 you are talking about --

2 **A.**   Correct. Yes. This -- this image appears to contain a

3 number of features and bands which are not present in the raw

4 image.

5   **MR. TYLER:** Ms. Cornich, if we can go to the next

6 page.

7 **BY MR. TYLER:**

8 **Q.**   What are we looking at here, Dr. Brookes?

9 **A.**   So this is comparing the pattern of bands in the white box

10 image with the pattern of bands in the extra image that we saw

11 at the bottom of the page previously. Again, a number of noise

12 features are carried over. The arrow over on the far right

13 indicates a small vertical blemish to the top left of the band.

14 That appears in both images. If we count a couple of bands

15 over, on the left here, you can see there is a band that

16 appears to have its bottom right corner sheared off as

17 indicated by the red line. And then the arrow in the middle of

18 the image there appears to be an indentation in the top right

19 corner of this band.

20   So these bands essentially overlap and this leads to the

21 conclusion that these solid bands in the third image were the

22 source for the bands in the white box.

23 **Q.**   If we can go to the next page?

24 **A.**   So this shows an ORI droplet of those same bands. What's

25 important to realize here is not just each individual band.

1 It's the size, the shape, the slope, the positioning, the

2 spacing between the bands. All of that is also the same.

3   **MR. TYLER:** Ms. Cornich, if you can go back to the

4 previous slide and blow up the bottom of this one.

5 **BY MR. TYLER:**

6 **Q.** Dr. Brookes, is there anything different that you observed

7 about the resolution here?

8 **A.** So these bands are, indeed, very unusual looking.

9 Typically when we see bands, the amount of noise in an image

10 should be uniform across the image. What you are looking at

11 here is, indeed, there are blotches of noise and pixilation

12 and, you know, essentially fuzz in the background of the image.

13 You know, the little spots here and there. The bands, however,

14 are very unusual because they appear to be sharp. They are

15 very sharp edges. And that is highly unusual to find a

16 different resolution. They almost look as if they are

17 different resolution. It's highly unusual to find bands of a

18 different resolution come against a generally noisy, fuzzy,

19 blotchy background.

20 **Q.** When you say "highly unusual," is that something you ever

21 observed in your own blots?

22 **A.** That is not something I ever observed in my own blots or

23 anybody else that I know.

24   **MR. TYLER:** Ms. Cornich, if we can go to I believe

25 it's Page 6 now.

1   **BY MR. TYLER:**

2   **Q.**   Dr. Brookes, can you tell us what we see here on this

3   page?

4   **A.**   So this is a type of analysis which was described in the

5   original pipeline. This is a histogram analysis, so what this

6   is doing is basically measuring the number of black and white

7   and all the shades of gray in between, the number of pixels at

8   each shade.

9   So, looking over on the left is this extra image. If we

10 look here, we have taken a section of that image in red and

11 blown it up and put it in the middle here. And what I have

12 done now is to highlight in blue some normal looking Western

13 blot bands. These are -- this is what Western blot bands look

14 like. They are black in the middle. They fade at the edges.

15 They're fuzzy as you get further out from the center.

16   So, in Photoshop what can be done is a histogram analysis

17 and so over on the right this is a graph showing on a scale

18 along the bottom, black on the left and gray and white on the

19 right, gray in the middle showing the distribution of different

20 pixel intensities.

21   So that's a very common standard looking pixel intensity

22 histogram. In contrast, if we then go to the unusual looking

23 bands, these are highlighted in blue here and the histogram of

24 those is shown in the top right. And what I would like you to

25 focus on is this right here. There is an unusual concentration

1 of pure black pixels in this histogram. This is not seen.

2 This is highly unusual. This would be seen if, for example, I

3 were to add bands digitally using pure black color. This is

4 not seen for natural looking bands as you see by comparison

5 with the histogram below.

6 **Q.**   When you say it is not seen, have you ever seen that in

7 any of your blots?

8 **A.**   I have seen that in other analyses that I have done of

9 other suspect images outside of this case. I have used

10 histogram analysis to actually show that certain bands are not

11 part of a block and have a different profile and came from

12 somewhere else.

13 **Q.**   But in your own blots --

14 **A.**   But in my own blots, I haven't seen this.

15   **MR. TYLER:** Ms. Cornich, if you could bring up

16 Exhibit-23.

17 **BY MR. TYLER:**

18 **Q.**   Could you just tell us what this is, Dr. Brookes?

19 **A.**   This is a description of an analysis method that was

20 applied called a terminal digit analysis in report number 5.1.

21 Do you need me to go in to what was found or --

22 **Q.**   Yeah. If we can go to the bottom and get the last

23 paragraph of Page 2. First of all, can you explain what

24 terminal digital analysis is?

25 **A.**   Okay. So, when numbers are generated from randomly

1 occurring stochastic processes, such as biological experiments,

2 the last digit on the right has an equal probability of

3 occurring across the range. So between zero and nine, one will

4 be the last digit, the exact same number of times that two or

5 three or four or five or six will be the last digit.

6   So, in a terminal digit analysis, we basically take all of

7 the numbers in a data set, and so in this particular example

8 you can see there are 3,208 numbers. We would then expect each

9 terminal digit to appear 320 times. The actual number of

10 appearance of the terminal digit is shown in the third column

11 right here.

12   As you can see, for example, number seven appears more

13 often than expected and number nine appears way more often than

14 expected. We can perform a statistical test to compare the

15 observed versus the predicted occurrence. And the value that

16 is reported in red is essentially a probability. It's a

17 probability that this set of numbers arose from a random

18 stochastic process such as a biological experiment.

19   That probability in this case for this data set is one in

20 a hundred million. There is a one in a hundred million

21 likelihood that these numbers came out this way from a random

22 stochastic process.

23 **Q.**   Just to circle back, what were the data points? Where did

24 they come from?

25 **A.**   These were densitometry data for Western blots in the

1 Journal of Neuroscience paper.

2 **Q.**   Dr. Brookes, in the course of your work on this case, did

3 you ever find a raw image that matched up to any bands --

4 matched up to the bands of the white box or published image in

5 the images that you looked at?

6 **A.**   No.

7 **Q.**   What did you conclude -- we didn't cover every report here

8 during your testimony. But what did you conclude about the

9 various figures we reviewed in terms of the figures matching

10 the research record?

11 **A.**   I concluded overall that there were numerous examples of

12 bands appearing in the white box and the final published

13 versions of images that have absolutely no provenance

14 whatsoever in the underlying raw data images.

15   I also concluded that there were problems with the

16 statistics from the densitometry and the data presented in the

17 graphs. There were also a number of just physical

18 impossibilities, for example, regarding the pH scales for the

19 isoelectric focusing, regarding having more than a hundred

20 percent of a protein being in a particular conformation on the

21 Excel spreadsheet and then having, for example, number nine

22 appear way more often than is statistically probable in the

23 final data set.

24   So my general conclusion is that on numerous occasions

25 here the data has been fabricated.

1 **Q.**   Does that include reports that we covered today and also

2 ones that you entered and the exhibits that we did not cover

3 today?

4 **A.**   Yes.   Everything is entered into evidence.

5 **Q.**   With respect to all the images that you conclude were

6 fabricated, did any of them lead to the weakening of the

7 conclusion in the grade application or article with respect to

8 PTI125 or its diagnostic companion?

9 **A.**   No.   Frequently the alterations that were done, that

10 appear to have been done to the images strengthen the

11 conclusions.

12   **MR. TYLER:**   Your Honor, if I may have one moment?

13   **THE COURT:**   Okay.

14   **MR. TYLER:**   Nothing further, Your Honor.

15   **THE COURT:**   Okay.   Before we go to cross-examination,

16 I normally wait until I get until the end of all testimony to

17 see if I have any questions, but there is one I just want to

18 make sure I understand that will help me with even the cross.

19   I don't think you really explained what a white box image

20 is and where it comes from.   Maybe you can just clarify that

21 for me before we get to the cross-examination.

22   **THE WITNESS:**   Okay.   So I was provided with sets of

23 images by Agent Weeks.   I was provided typically with a raw

24 image and a corresponding white box image.   I say corresponding

25 because they essentially have the same file name and share a

1 number of features. I don't know where those images came from.

2   **THE COURT:** What is a white box image? Is that an --

3   **THE WITNESS:** White box is just the terminology that

4 I applied to those images to distinguish them from each other.

5 The origin of the white box is unknown to me.

6   **THE COURT:** I'm just trying to even understand what

7 we are talking about. Are you saying there was an image that

8 instead of having this sort of grayish background it was like a

9 letter box just focused on the bands?

10   **THE WITNESS:** One area. Yes. Sorry, Your Honor.

11 I'm interrupting you.

12   **THE COURT:** Is that a normal thing to do in science,

13 generally, is you might generate a white box to focus on

14 certain areas or not?

15   **THE WITNESS:** That breaks the fundamental rule of

16 image analysis which is that you have to treat the whole image

17 equally, so it's highly unusual to find a white box that --

18 which appears to be superimposed upon the raw image in that

19 way.

20   **THE COURT:** Okay. I think I understand, but we will

21 go to cross-examination now. Thank you.

22   Just to clarify, Mr. Tyler, Exhibits-50 and 52, when those

23 came up, so those are in evidence for purposes of the hearing.

24 Any issues with that from either side? Fifty and 52?

25   **MS. BEIDEL:** No, Your Honor.

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 1              MR. TYLER:  No, Your Honor.

 2              THE COURT:  Go ahead, Ms. Beidel.

 3              MS. BEIDEL:   Perhaps starting with exhibits first.

 4   If it's acceptable to the Court, I could let you know which

 5   exhibits I would intend to offer and see if the government has

 6   any objection.

 7              THE COURT:  Sure.

 8              MS. BEIDEL:  So Exhibit-87 to 87-6, 91 and 91-1 and

 9   then everything from 101A through 137 and 146 through 161.

10              MR. TYLER:  I'm sorry.  We are trying to -- can you

11   repeat that again?

12              THE COURT:  Just give us the range one more time.

13   Sorry.

14              MS. BEIDEL:  87 to 87-6, 91 and 91-1, 101A through

15   137 and 146 through 161.

16              THE COURT:  Okay.

17              MS. BEIDEL:  May I proceed, Your Honor?

18              THE COURT:  Any issues with those, Mr. Tyler?

19              MR. TYLER:  If you can just give me one moment, Your

20   Honor.

21              THE COURT:  Okay.

22              MR. TYLER:  Your Honor, we have no objection with the

23   exception of the video clips because we just haven't had a

24   chance to review those yet, but everything else we are fine.

25              THE COURT:  What numbers are those?
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1   **MR. TYLER:** 135 through 137.

2   **THE COURT:** Okay. Are you going to use those in any

3 great way?

4   **MS. BEIDEL:** No. That's fine, Your Honor.

5   **THE COURT:** Okay.

6   **MS. BEIDEL:** I can skip that.

7   **THE COURT:** Okay.

8   **CROSS-EXAMINATION**

9 **BY MS. BEIDEL:**

10 **Q.**   Good morning, Dr. Brookes.

11 **A.**   Good morning.

12 **Q.**   I want to start where we stopped which was you were

13 discussing -- you first said alterations that were done and

14 then you corrected yourself to alterations that appear to have

15 been done. Tell me why you made that distinction.

16 **A.**   I'm basing my conclusions on the appearance of what was

17 presented to me.

18 **Q.**   And it's correct that you don't know for certain that

19 those alterations were made in the way that you testified to;

20 correct?

21 **A.**   I don't know how the alterations were made to the images.

22 I know that they were made digitally for the reasons described,

23 but how digitally, I don't know.

24 **Q.**   It's your testimony under oath today, as you sit here,

25 that you are certain that there were digital alterations to

1 these images?

2 **A.**   Correct. Yes.

3 **Q.**   You could not be wrong in the way that you were wrong when

4 you accused your colleague at the University of Rochester of

5 manipulation?

6 **A.**   I do not believe I am wrong when I testify that these

7 images were digitally altered.

8 **Q.**   And isn't it true that how you learned you were wrong in

9 that case was that that colleague was given the opportunity to

10 provide you with an original that convinced you that you were

11 wrong?

12 **A.**   The colleague came to my office, yes, sir.

13 **Q.**   And in this case, you haven't had any conversations or

14 other interactions with Dr. Wang through which he would have

15 the opportunity to provide you with such originals; correct?

16 **A.**   I have never met Dr. Wang before.

17 **Q.**   So, all you have is the record provided to you by Special

18 Agent Weeks?

19 **A.**   That -- yes, that is correct.

20 **Q.**   And if there were, say, other originals that showed the

21 provenance of the bands that you analyzed, then your opinions

22 could change; correct?

23 **A.**   If those original images exist, it still would not change

24 the fact that the bands do not exist in the raw image, so it

25 would be unlikely to change my opinion. It would depend on the

1 data that was presented, if such images do, indeed, exist.

2 **Q.**   You connected the raw images to the white box images

3 essentially by assuming that the only way that those white box

4 images could exist there is if they were a component of that

5 original image; is that fair?

6 **A.**   No. The white box, as I believe was just discussed with

7 His Honor, my thought is that the white box is a digital

8 addition to the raw image. The white box was not an original

9 component of the raw image as you just stated.

10 **Q.**   So, in other words --

11 **A.**   Because if it was, then it should be possible to

12 manipulate the raw image to make the white box appear and, as

13 was described, that is not possible.

14 **Q.**   So you can see that the white box images are cut and

15 pasted on top of the supposed raw images; correct?

16 **A.**   I don't know how the white box or the bands within the

17 white box came to appear on the raw image. All I know is that

18 the information; namely, the bands, is not present in the raw

19 image.

20 **Q.**   Well, didn't you just testify that it's impossible to make

21 the white box image by altering the raw image?

22 **A.**   It's impossible to make it by altering the raw image using

23 acceptable image manipulation standards such as altering the

24 brightness of the -- or the contrast of the whole image.

25 **Q.**   So one possibility is that the white box image is cut and

1 pasted on top of the supposed raw image; correct?

2 **A.**   That is a possibility. I don't know why anybody would do

3 that. It's not a standard scientific practice.

4 **Q.**   So, if the white box image were cut and pasted on top of

5 the raw image, then all of your analysis talking about the

6 other things and the raw image outside of the white box are

7 irrelevant; correct?

8 **A.**   No.

9 **Q.**   Well, if the white box image is the only image that lead

10 to the figure, then if you are talking about sourcing the rest

11 of the image to the raw, that does not matter?

12 **A.**   The bands in the white box image are of the data. And if

13 the white box image was pasted in from another image, albeit

14 unknown at this stage, then that other image is the raw data,

15 in which case given that nobody has seen those other images

16 that by your definition states that the raw data do not exist.

17 **Q.**   So would you agree with me that there exist some other

18 image that contains the raw data or at least existed at some

19 time?

20 **A.**   There could be additional images that contain the pattern

21 of bands seen in the white box image. At no point during these

22 investigations have I found such images.

23 **Q.**   But you can't testify with certainty as you sit here

24 today, that such images do not exist; correct?

25 **A.**   I cannot say that they do not exist. What I can say is

1 that from a standard scientific practice, it would be expected

2 that those images should be retained and when raw data is

3 requested, those should be the images that would be provided

4 not, as you are attempting to say, some unrelated raw image

5 with splotches and no bands. If somebody asked me for the raw

6 data, I would expect that I would provide them with the raw

7 data, not some unrelated image.

8 **Q.**   But weren't there two kind of ultimate rules about image

9 manipulation and presentation that come from this JCB paper.

10 Do I have that right?

11 **A.**   Correct. Yes.

12 **Q.**   And is one of them what you just said?

13 **A.**   There are two general rules. One is we shouldn't adjust

14 an image to change the informational content of that image.

15 And the other is that if provide -- if manipulating an image,

16 we should adjust the whole image evenly to the same level.

17   So, for example, taking a raw image and pasting in another

18 image that contains the white box bands, that changes the

19 informational content of the raw image so that breaks that

20 rule.

21 **Q.**   Is there anything in the JCB paper about the number of

22 years one needs to retain that underlying data?

23 **A.**   At the time those guidelines were written, which is I

24 believe 2006, I do not recall if there was anything in there

25 about data retention standards. As I'm sure you are aware, the

1 federal government has recently revised its standard regarding

2 data retention policies relative to the funding period of a

3 grant. The typical expectation is six years after the grant

4 has finished all the publications have been published.

5 **Q.**   So, for example, just using that six-year period, the

6 paper that you referred to in Neurobiology of Aging was

7 published in 2017 suggesting the work was done previously;

8 correct?

9 **A.**   Yes.

10 **Q.**   And so we would be outside of the retention period of that

11 law image and data according to that statement; correct?

12 **A.**   At the time I was presented with those figures for the

13 purposes of this investigation it was 2002, which would had

14 been within the statute of limitations for data retention.

15 **Q.**   I think you meant 2022. You said 2002.

16 **A.**   Sorry. 2022. Sorry. That would be five years after that

17 paper was published. And, generally, in that role from the

18 N.I.H. it's the latter of either when the paper was published

19 or when the grant funding ended.

20   So I don't know when the funding that was used to do those

21 studies ended relative to when the paper was published.

22   **MS. BEIDEL:** Your Honor, could I approach to get

23 Exhibit-52?

24   **THE COURT:** Yes.

25 **BY MS. BEIDEL:**

1 **Q.**   In your word, you said all of the bits. I want to talk

2 about all of the bits of the experiment.

3 **A.**   Okay.

4 **Q.**   That lead to ultimately the digital images that you

5 analyzed, so working backwards, there is digital images. We

6 just talked about how there could be potentially other digital

7 images that you didn't see; correct?

8 **A.**   You correct.

9 **Q.**   Then there is film that looks like this; correct?

10 **A.**   That is the developed film. Yes.

11 **Q.**   Developed film. Did you review any developed film from

12 Dr. Wang's lab in connection with this case?

13 **A.**   No. No developed films were provided.

14 **Q.**   And then using this apparatus there is a gel that's

15 transferred to a nitrocellulose membrane; correct?

16 **A.**   Uh-hum.

17 **Q.**   And did you review any nitrocellulose membranes or gels in

18 connection with Dr. Wang's?

19 **A.**   Typically gels are very fragile. They don't store well,

20 so it's fairly common practice after the transfer of the gel to

21 the membrane to throw the gel away. Sometimes we will stain

22 the gel to see if there is any residual protein left in the gel

23 to see if the transfer happened properly. The nitrocellulose

24 membranes, typically those are kept for a week or two after.

25 The main reason we don't keep a lot of nitrocellulose around,

1 it is explosive. And keeping large quantities of

2 nitrocellulose in binders in the lab is not a very safe

3 practice. So the nitrocellulose members are also typically

4 discarded a week or two after the blot has been developed onto

5 the film.

6 **Q.**   So fair to say you didn't review any gels or

7 nitrocellulose membranes for this case?

8 **A.**   No. That would be unusual.

9 **Q.**   Okay. You've talked a lot about Special Agent Weeks

10 providing you with selections of images I guess going back to

11 2022; is that right?

12 **A.**   Correct. Yes.

13 **Q.**   Did you provide Special Agent Weeks with certain

14 parameters as to what images you wanted him to provide?

15 **A.**   No.

16 **Q.**   He chose the images and sent them to you; correct?

17 **A.**   Agent Weeks sent them to me in sets typically of three.

18 Here is a grant. Here is some images I would like you to

19 analyze relative to that grant.

20 **Q.**   Are you aware of whether Special Agent Weeks had any

21 particular methodology for choosing those images?

22 **A.**   I don't know how those images were chosen.

23 **Q.**   You mentioned you didn't speak with Dr. Wang in connection

24 with this case. Did you speak with anyone else from his lab at

25 CUNY or anyone from Cassava, the company that he was working

1   with?

2   **A.**   No.   Not at Cassava.   I believe when the original

3   discoveries were made regarding the figures in the papers -- so

4   I got into this case because I was asked by a colleague to look

5   at a set of raw data that were provided by Dr. Wang to the

6   editors of the paper, of the Journal of Alzheimer's Disease and

7   Therapy.   In doing that, I found misconduct evidence in the

8   preparation of those figures.   I reported that.   One of the

9   parties that I reported that to was the research integrity

10   officer at CUNY.

11   **Q.**   Do you know whether CUNY concluded that there was any

12   research misconduct in connection with that allegation?

13   **A.**   I don't know regarding that allegation.   I know CUNY ran

14   an investigation, and I believe it's still ongoing, so the

15   results of that are unknown to me.

16   **Q.**   So, as we sit here today, CUNY has not made any final

17   findings with respect to research misconduct on behalf of

18   Dr. Wang, as far as you know?

19   **A.**   To the best of my knowledge, CUNY's investigation is still

20   ongoing.

21   **Q.**   Have you ever visited Dr. Wang's lab at CUNY?

22   **A.**   Never.

23   **Q.**   Have you in any way observed his Western blotting process

24   recorded or otherwise?

25   **A.**   No.

1 **Q.**   Did you speak with Special Agent Weeks about whether you

2 could have access to any hard copy files that might exist in

3 Dr. Wang's lab? Films? Lab notebooks or the like?

4 **A.**   Yeah. I believe I may have asked are there films, are

5 there lab notebooks.

6 **Q.**   And were you provided with any?

7 **A.**   If those materials exist, I was not provided with them.

8 I'm not aware of their existence. My analysis was solely based

9 on the digital files that were provided to me by Agent Weeks.

10 **Q.**   And those files were provided by e-mail, and then I

11 believe you said on a disk at some later point?

12 **A.**   Yes. There were two DVD's, one of which contained JPEGs

13 and another which contained PowerPoint files.

14 **Q.**   And I think your number was something like 2,300?

15 **A.**   2,300 JPEGs. The original number was slightly higher. My

16 understanding is that disk contained JPEGs from a computer, and

17 there were a number of images on the case including, for

18 example, photographs and desktop backgrounds which were

19 irrelevant to the case, so when they were removed 2,300 is the

20 number of JPEGs relevant to the case that were on that disk.

21 **Q.**   We've received something over a million records in

22 discovery in this case. You certainly did not review all of

23 that at any point?

24 **A.**   In the case of the PowerPoints and the JPEGs, it was a

25 frequent practice of mine to have a window open on one side of

1   my desktop with the enlarged preview feature open for the JPEGs

2   and then a JPEG of interest in the case on the right and scroll

3   through 2,300 images to see if I could find one that matched.

4   **Q.**   Right.

5   **A.**   And that was also done with the PowerPoints. In one case

6   I sat for an afternoon and opened 2,900 PowerPoints in order to

7   look at the images within those PowerPoints to see if any of

8   them matched, so there was somewhat of a group-force approach

9   to finding matches.

10 **Q.**   There is some delta, obviously, between that 2,300 plus

11 2,900 and the government produced records in this case and you

12 didn't have access to any of that; correct?

13 **A.**   No.

14 **Q.**   Have you ever reviewed any correspondence from Dr. Wang,

15 e-mails, phone records, voicemails, anything like that?

16 **A.**   None of those have been provided to me.

17 **Q.**   Did you do meta data analysis of the images that you

18 analyzed?

19 **A.**   Other than the title, no. One of the issues here is that

20 the files were sent by e-mail and so, for example, when I

21 received that file and then save it to my computer, now the

22 creation date of that file is when I saved it. So in many

23 cases the meta data would not had been any use to my analysis.

24 My understanding is that Agent Weeks has that data.

25 **Q.**   But if he does have that data, you haven't analyzed it?

1 **A.**   I was not told anything about the meta data to provide

2 context to the images that I analyzed.

3 **Q.**   So, as you sit here today, you can't use a forensic meta

4 data analysis traced backwards from the publication image in

5 the grant application, let's say, to the raw image that you

6 analyzed?

7 **A.**   The titles do provide some hints and in a couple of cases,

8 regarding the PowerPoint files specifically, I was able to find

9 the creation date of the PowerPoint file and that matched

10 relative to the time frame in which a paper or a grant was

11 submitted. And that is in the reports textually.

12 **Q.**   Are you familiar with an MD5 hash value of a document?

13 **A.**   No. That's not an analysis that was performed in this

14 case.

15 **Q.**   Okay. To the extent any of the images in this case have a

16 unique digital fingerprint number, you did not perform an

17 analysis of that to trace it back to the original file?

18 **A.**   No. Correct.

19 **Q.**   Okay. Now, you mentioned the naming convention where a

20 lot of these files end in 11; correct?

21 **A.**   Correct, yes. Many of the white box images ended in dash

22 11 or dash 112 or dash 1212.

23 **Q.**   And you also mentioned there could be other stripped and

24 reprobed versions of an image or perhaps different exposure

25 times of an image for the same experiment; is that right?

1   **A.**   We specifically ruled out stripping and reprobing as a

2   potential explanation for additional images because when that

3   happens, the blog comes out of the cassette, gets washed and

4   gets exposed to another antibody and reexposed. The chances of

5   being able to line up the film in exactly the same position the

6   second time around is zero. Everything is going to be off by

7   fractions of millimeters. The noise pattern will be different.

8   So we specifically ruled out stripping and reprobing as a

9   potential source of additional images because then the noise

10   pattern would not be the same between the raw and the white

11   box.

12   **Q.**   Setting aside that source question for a second, there are

13   certainly some laboratory practices when you are producing

14   Western blots that you could use the same set of samples and

15   the same gel or membrane and either do different exposure

16   letters, strip and reprobe it and probably some other options

17   to create multiple film images?

18   **A.**   So the example you have, the piece of film you have, that

19   is actually two Western blots exposed four times, so we put it

20   down in the cassette once, flip it around, do it again, turn it

21   upside down, do it again and then flip it one last time. So

22   you will see that the bands in the four quadrants of that piece

23   of film are a slightly different darkness or brightness because

24   those are four different exposures, and I believe in the top

25   corners of there you can see it says like ten seconds, 30

1 seconds. The time of each exposure is written in the corners

2 of the piece of film.

3 **Q.**   So using the film in Exhibit-52, for example, there is

4 four different exposure times of two --

5 **A.**   Of two Western blots.

6 **Q.**   So we have eight images?

7 **A.**   Correct.

8 **Q.**   And there is really no limit on how many different

9 exposures one could run to get to the ideal image; correct?

10 **A.**   Correct. You can expose for ten seconds. You can expose

11 for five minutes. Generally, with exposures what tends to

12 happen is if you have very very low abundance proteins the

13 longer you go with the exposure you may, indeed, be able to

14 pick up the protein of interest, but the background noise is

15 going to become oppressive to the point where you can't

16 actually see the bands because the whole membrane will turn

17 black.

18 **Q.**   So back to Dr. Wang's naming convention. You have some

19 without a terminal digit and some 11s. It's certainly possible

20 that there are images one through ten out there somewhere;

21 correct?

22 **A.**   It's possible there are additional digital images, but

23 that still doesn't explain where the bands in the white box

24 image came from.

25 **Q.**   Did you do any investigation as to how Dr. Wang was taught

1 to do Western blotting?

2 **A.**   That's not material to my role here, how he was taught.

3 **Q.**   Let's say, for example, he was taught not to use molecular

4 weight markers, that is not something you would be aware of;

5 correct?

6 **A.**   That would be highly unusual and that would be bad

7 scientific training. If I may add for the record, the cost of

8 molecular markers, one tube with enough for a hundred

9 experiments costs about $35, so this is not an expensive

10 burdensome addition to any experiment. This is something that

11 costs pennies which anybody running Western blots does by

12 default.

13 **Q.**   You are familiar with a publication or a set of

14 publications called Plus One; correct?

15 **A.**   Plus One is a journal I believe. When was it founded?

16 20 -- late 90s.

17   **MS. BEIDEL:**   Ms. Blackwood, could we show

18 Exhibit-159, please?

19 **BY MS. BEIDEL:**

20 **Q.**   So you will see, Dr. Brookes, that this is an article from

21 Plus Biology called blind spots on Western blots, assessment of

22 common problems in Western blot figures and methods reporting

23 with recommendations to improve them. And the received date is

24 June 7, 2022.

25   Do you see that?

1 **A.**   Correct. Yes.

2 **Q.**   If you look in the abstract about midway down it says, our

3 data show that most published Western blots are cropped and

4 blot source data are not made available to readers in the

5 supplement. Publishing blots with visible molecular weight

6 markers is rare and many blots additionally lack molecular

7 weight labels.

8   Do you see that?

9 **A.**   I see what that says. Yes.

10 **Q.**   Have you done an analysis of Western blots similar to this

11 paper to determine the prevalence of use of molecular weight

12 markers?

13 **A.**   That has not been an area that I have actively researched.

14 But I would say that this statement here from the authors is a

15 critique. This is a statement of a problem in the scientific

16 literature. So, regardless of whether something is common,

17 this is being flagged in this paper because it's being

18 described as a lack or a problem. That problem may, indeed, be

19 very very common, but that does not make it not a problem.

20 **Q.**   I understand that. But wasn't it your testimony that

21 molecular weight markers are very frequently used, especially

22 in all the Western blots you've observed?

23 **A.**   It was my testimony and I stand by that testimony.

24 Western blots, standard use of Western blots includes molecular

25 weight markers. This is talking about published Western blots,

1 so it can be very common, in fact, to use a Western blot

2 molecular weight marker on the initial gel and then for

3 whatever reason, maybe space constructions in the journal, to

4 leave off the molecular weight markers in the final published

5 version.

6 **Q.**   As you sit here today, can you direct us to a paper that

7 requires the use of molecular weight markers in Western

8 blotting?

9 **A.**   A journal that I'm on the editorial board of. The Journal

10 of Molecular and Cellular Cardiology, JMCC. They have a series

11 of data standards. That data standards essentially state that

12 not only must you include molecular weight markers on your

13 images, if you produce any Western blot in that journal, you

14 are required to provide a supplemental data file that includes

15 all of the original gel images with their molecular weight

16 markers to the journal during the submission process.

17   And more and more journals are now adopting data

18 transparency standards where it is common practice to not only

19 demand the Western blots, but the original images with the full

20 height gels and the molecular weight markers that led to those

21 images.

22 **Q.**   That's for that particular journal?

23 **A.**   That's for that journal and I know of several others who

24 have documented similar standards. This is an area where many

25 journals now are becoming more stringent in the quality of

1 Western blot data that they will accept for publication.

2 **Q.**   Has the N.I.H. adopted that standard?

3 **A.**   The N.I.H. does not publish papers, so they would not have

4 need to.

5 **Q.**   So at the time that Dr. Wang performed his research, the

6 N.I.H. did not have a particular standard requiring use of

7 molecular weight markers; isn't that fair?

8 **A.**   That's fair to say. I don't know why the N.I.H. would

9 dictate that standard. Typically, N.I.H. would not dictate

10 standards about how individual experiments are supposed to be

11 done. I'm not aware that they do that for any other method

12 aside from Western blotting. They don't tell you how to use a

13 microscope, for example. They don't tell you how to do other

14 biological science methods.

15 **Q.**   You've, obviously, given a number of opinions in this case

16 over a period of years; correct?

17 **A.**   Given opinions in this case. I have provided written

18 reports with opinions.

19 **Q.**   Do you hold all of the opinions contained in those reports

20 with the same degree of certainty?

21 **A.**   If I signed it, then I stand by it.

22 **Q.**   So the opinion that molecular weight markers is required,

23 for example, is held to the same degree of certainty as the

24 opinion that, for example, there is manipulation in a certain

25 figure; is that fair?

1 **A.**   I would say in my opinion, yes, molecular weight markers

2 are required on gels. And as just mentioned, many, many

3 journals agree with me on that.

4 **Q.**   But at least one says it's prevalent not to have them;

5 correct?

6 **A.**   There is a publication in Plus One which criticizes the

7 field by saying that they are frequently left off published

8 images, but that publication does not say anything about raw

9 data.

10 **Q.**   You know this is a criminal case; correct?

11 **A.**   I am aware it's a criminal case, yes.

12 **Q.**   And it requires intentional misconduct; correct?

13 **A.**   I am not aware of what standard is being applied in the

14 trial in order to reach a verdict --

15 **Q.**   Are you making an --

16 **A.**   -- intentional.

17 **Q.**   -- opinion in this case that there was intentional

18 misconduct by Dr. Wang?

19 **A.**   I have expressed an opinion that Dr. Wang committed

20 intentional misconduct, yes.

21 **Q.**   Is it possible, in your mind, that Dr. Wang committed

22 negligent conduct that lead to at least some of the opinions

23 that you discuss in your reports?

24 **A.**   Are we in trial already? I'm struggling to --

25 **Q.**   It's a question.

1 **A.**   -- understand. We're in a Daubert hearing.

2   **MS. BEIDEL:** Your Honor, I would ask him to answer

3 the question.

4   **THE COURT:** Just answer the question. You are under

5 oath.

6   **THE WITNESS:** Can you ask it again, please?

7 **BY MS. BEIDEL:**

8 **Q.**   Is it possible, in your view, that Dr. Wang was negligent

9 when he engaged in some of the conduct that you describe in the

10 opinions in your reports?

11 **A.**   Some of the conduct I would classify as negligent. For

12 example, when we think about some of the Excel sheets that

13 appear to be some calculations in those sheets which could be

14 simply honest mistakes. Yes, there are. However, generally

15 speaking, in the field of scientific misconduct, there can be

16 an accident. There can be two accidents. There can be five

17 accidents. When there are hundreds of accidents, the -- and

18 they all pile up, it becomes increasingly unlikely that that

19 can be attributed to incompetence or sloppiness.

20 **Q.**   When you issued your opinions in the reports contained in

21 the exhibits, did you specify in which circumstance you were

22 talking about potentially unintentional error?

23 **A.**   That is written in the reports. I believe in some of the

24 annotated Excel sheets you can see, for example, where there is

25 a formula that has been used to calculate the densitometry

1 relative to the NR1 protein. And that formula has been copied

2 and pasted. Unfortunately, a dollar sign was inserted in the

3 formula and that has an effect of locking a particular cell.

4 And so when that formula was copied and pasted instead of it

5 transposing down the sheet, everything got referenced to the

6 wrong cell by mistake. That can be a common mistake from there

7 just being a dollar sign in the formula by accident. Yes. And

8 that was described in the particular report.

9 Q.   So your intention is that if it was your opinion that

10 there could had been a harmless error caused for some issue you

11 would have indicated it?

12 A.   Alternative explanations were described in the reports

13 regarding instances in which things could have come about by

14 error.

15 Q.   I want to talk about your method for a bit and focusing

16 first on how it developed. So ultimately we see something that

17 you called analytical pipeline for Western blot images. That's

18 your method; correct?

19 A.   That's a family of techniques that were used in this case,

20 yes.

21 Q.   And is that the method you used to conduct your

22 analysis for purposes of this case?

23 A.   Yes.

24 Q.   Have you used that method in other let's start with

25 publications?

1 **A.**   Generally speaking, in the field of research integrity and

2 scientific investigation, one does not publish one's findings

3 in the scientific literature.

4 **Q.**   So the answer is, no, you have not used those methods?

5 **A.**   Those methods have not been used in a manner in which the

6 outcome has directly been published. The general reason for

7 that is that when you're looking at published images in the

8 scientific literature, the journals own the copyright of those

9 images.

10   So, it's not possible, for example, to do what I have done

11 on a number of the reports here which is to show a published

12 image alongside an analysis of that image. A journal is

13 unlikely to permit one of their figures to be reproduced for

14 the purposes of pointing out that that figure has been

15 inappropriately manipulated.

16   They're not likely to release copyright to allow that to

17 occur, so, generally speaking, I'm not aware of anybody in this

18 research integrity field who publishes their primary findings.

19 **Q.**   So, you are not aware of any paper that uses the three

20 stage pipeline analytic method that you describe in this case;

21 correct?

22 **A.**   All of the methods described are in use in the research

23 integrity field. They may come under different names, so

24 essentially what is described in the report as a three-stage

25 pipeline, a forwards analysis, that is something that is used

1   in the literature. A reverse analysis, that is something that

2   is used. Looking for unusual and additional features in

3   images, that is a method that's used. If they may not be

4   described in this exact way all synthesized in terminology, but

5   each of those methods has been used and while the findings of

6   those methods, the primary findings may not have been

7   published, there are numerous publications where people have

8   used these methods and made aggregate findings.

9   For example, regarding prevalence of particular types of

10 image manipulation in the literature. Ferric Fang, Arturo

11 Casadevall, Elizabeth Bik, there are a number of publications

12 by these individuals where they have analyzed thousands of

13 papers using these exact methods and then come up with broad

14 conclusions regarding percentages of manipulated images in the

15 literature.

16 **Q.**   And you are certain of these exact methods?

17 **A.**   They are a subset of these methods.

18 **Q.**   A subset?

19 **A.**   I know for a fact that Elizabeth Bik, for example, uses

20 one of the tricks that is described in the report, very old

21 monitors, very old computer monitors, LCD monitors, not OLED or

22 modern laptop screens. The contrast of the image can be

23 adjusted by simply tilting the screen backwards, so one of the

24 techniques that Elizabeth Bik uses is for rapid screening of

25 images is open a paper, tilt the screen, open a paper, tilt the

1 screen as a quick way of looking to see if there are any

2 undisclosed splicing seams within a Western blot because it's a

3 very quick way of looking at an image and seeing if it's

4 worthwhile for further analysis. That's one example of a

5 method --

6 **Q.**   Did you use --

7 **A.**   -- that was described in the pipeline of adjusting

8 brightness and contrast. That's a method that's been used to

9 publish. I don't use that method now because I have a new

10 laptop that has an OLED screen and that method no longer works.

11   **MS. BEIDEL:** Okay. Let's look at Exhibit-147,

12 please, Ms. Blackwood.

13 **BY MS. BEIDEL:**

14 **Q.**   You will see, Dr. Brookes, that this is an e-mail from you

15 to Special Agent Weeks dated October 6, 2022. Do you see that?

16 **A.**   Correct. Yes.

17 **Q.**   And it says that there are two files attached and one is

18 an analysis outline. It says, analysis outline is the pipeline

19 methods document with edits as discussed.

20   Do you see that?

21 **A.**   Correct.

22 **Q.**   If we turn to the second page, this is at this point at

23 least the proposed analytical pipeline for Western blot images;

24 correct?

25 **A.**   Yes. This is, yes, a proposed pipeline.

1 **Q.** And what you mean by proposed pipeline is these are the

2 steps you intend to take to conduct the analysis in this case?

3 **A.** Correct. Yes.

4 **Q.** And so at this time at least you see on this page there is

5 three steps: Magnification, brightness and contrast adjustment

6 and the curves function and Photoshop; correct?

7 **A.** Yes. Those are -- this is just the first page of the

8 document.

9 **Q.** Right. And scrolling on, then there is recoloring and

10 PowerPoint, histogram analysis, error analysis tool called

11 Photo Forensics; correct?

12 **A.** Correct.

13 **Q.** Finally, on the last page there is Image Twin and

14 sensitometry. Do you see that?

15 **A.** Yes.

16 **Q.** And nowhere in here is the droplet analysis, for example,

17 that you talked about; correct?

18 **A.** The droplet analysis is not listed in this initial

19 pipeline, correct.

20 **Q.** And there was the example where you took data from the

21 paper, and you took the graph and backed up to the Excel file

22 and analyzed that Excel file. That type of analysis is not

23 mentioned in this pipeline either; correct?

24 **A.** This is about analysis of images. This descriptive

25 document does not deal with how the images are obtained, so

1 obtaining a PowerPoint and ungrouping and taking the images out

2 of that PowerPoint, that is just the process by which the

3 images are obtained, but that is not described in this document

4 which is about the analysis performed on the images once they

5 are in that.

6 Q.   I'll rephrase that. My question was confusing. I was

7 talking about actually taking the graph that appeared in one of

8 the publication images where you were able to extract it and

9 get to the Excel spreadsheet that we saw with all of your

10 comment bubbles.

11   Do you know what I'm referring to?

12 A.   Yes. The mechanism of extracting an Excel file from a

13 graph in a PowerPoint file was a later development during this

14 analytical process. I would argue that that doesn't come under

15 the agreement of image analysis, because what is being clicked

16 on is not a Western blot image. What is being right clicked on

17 to extract that Excel file is a graph and a graph is not an

18 image.

19 Q.   Well, either way, at least at this phase, there was not a

20 step that said, for example, look at the graphs or look at the

21 data and see whether there is something corroborative of the

22 opinion that you could find in that?

23 A.   That is described in the reports in which those

24 extractions were performed.

25 Q.   Right. I'm focused on the method. In the method, there

1 is not a discussion of that type of step; correct?

2 **A.**   At the time this method document was written, the full

3 scope of the type of data that would be made available to me to

4 analyze was not clear so it would be unusual if not knowing

5 what file types I could expect to be given, I would

6 predictively describe a method for extracting Excel sheets from

7 PowerPoint graphs, not even knowing the PowerPoint files

8 existed, and having been sent no PowerPoint files at that

9 stage, so --

10 **Q.**   So let's trace that --

11 **A.**   -- as I said, this methods document is an early iteration

12 of a planned pipeline for image analysis, and as the process

13 continued, additional tools such as extracting Excel sheets

14 from PowerPoint files was added to the arsenal of methods that

15 were used.

16 **Q.**   Okay. Let's trace the evolution of that analysis a bit.

17 Let's show Exhibit-149. You'll see that this is now an e-mail

18 from you to Special Agent Weeks dated November 14, 2022. So a

19 little over a month after the last one. And it says, three

20 updated analysis pipeline describing three stages categories of

21 analysis.

22   Do you see that?

23 **A.**   Correct.

24 **Q.**   And then if we move to the attachments, 149, you now see

25 what's called the analytic pipeline for Western blot images

1 that has the three stages reverse analysis, forward analysis

2 and further anomalies; correct?

3 **A.**   Correct.

4 **Q.**   So that we have gone from the eight potential methods of

5 analysis down to this three stage reverse analysis, forward

6 analysis and further anomalies?

7 **A.**   That's a misconception. The -- this describes three

8 stages of the analysis. The previous document describes eight

9 tools to be used during these three stages.

10 **Q.**   And it's called analytic pipeline for Western blot images

11 here and we go to Page 2 of Exhibit-147, proposed analytical

12 pipeline for Western blot images.

13   Do you see that?

14 **A.**   Yes. This is the early iteration.

15 **Q.**   Of the same thing; correct?

16 **A.**   This is an early iteration in which I called it a

17 pipeline. As you'll note, this does not have a number in the

18 top left. This was at a time where it was unclear how many

19 reports I would be asked to write and so, again, this is a very

20 early iteration in which I'm calling this a pipeline.

21 Subsequently, that nomenclature evolved to two documents, one

22 being the description of the methods, and the other being the

23 pipeline for the application of those methods and those were

24 then numbered reports.

25 **Q.**   Let's go to Exhibit-87-4 at Page 15. I think you will see

1 that this is now or I'll represent to you that this is the

2 current report as we understand it, report number three, with

3 the three stages, reverse analysis, forward analysis and

4 further anomalies. Do you see that?

5 **A.**   Correct. And then on the first line you will see it says

6 using the analytic tools described in document two.

7 **Q.**   Did you mean by that that you were going to use all eight

8 of those analytical tools?

9 **A.**   It does not say that here.

10 **Q.**   So you mean --

11 **A.**   It says, using the tools.

12 **Q.**   You mean you are going to do this three-stage analysis

13 pipeline using whichever of the tools you choose in that

14 particular circumstance?

15 **A.**   Whichever are the most applicable for the data. So, for

16 example, an ORI droplet analysis, as you have seen, is more

17 appropriate for comparing bands in the white box image to the

18 final published data. That would be less appropriate comparing

19 the white box image to the raw data because there are no bands

20 in common to see if they overlay, so the tools depend on which

21 stage of the analysis we are and, indeed, on the individual

22 properties of the image.

23   So, for example, in the case of the unusual square looking

24 black bands, in the extra image stage, that was an appropriate

25 place to apply a histogram analysis to show that those bands

1 have different properties to the other bands in that document.

2 You would not do a histogram analysis at every stage including

3 the white box.

4 **Q.**   So you use the tools that enable you to conclude there was

5 image manipulation?

6 **A.**   I used the tools that were most appropriate in order to

7 draw conclusions regarding the images.

8 **Q.**   If a tool would have, for example, indicated there was no

9 manipulation, you didn't use it; correct?

10 **A.**   I frequently did. I frequently used ORI droplets. I

11 frequently used histogram analysis. I applied tools because as

12 was already mentioned, we consider the number of alternative

13 explanations here for how these images came about. And so --

14 and as I've already described, as a scientist, it's important

15 to know when you are wrong and so you apply tools to -- to

16 figure out if you are wrong.

17 **Q.**   But it's not as if you walked through each of the eight

18 tools, you know, for every image you said number one, magnified

19 a pixel level detail. Number two, brightness and contrast. It

20 was not that regimented; correct?

21 **A.**   There was not a regimented pattern for applying all eight

22 of the tools in all three stages.

23 **Q.**   Okay.

24 **A.**   For example, three times eight, that would be 24 separate

25 steps for every single image analysis. That would generate an

1 inordinately large amount of paper.

2 **Q.**   And the government's paying you $150 an hour to do this

3 work?

4 **A.**   The government is paying me a consulting fee for the

5 process of this analysis. That is in line with standard

6 consulting fees for this type of work.

7 **Q.**   But eight steps for each image would have taken longer and

8 cost more; correct?

9 **A.**   Doing 24 separate steps would have drastically increased

10 the amount of time and, therefore, billable hours to the

11 government.

12 **Q.**   I don't want to take you through with every single one of

13 the reports. I'm conscious of your time and the Court's time.

14   But let's just talk about a couple of examples.

15   Can we go to Exhibit-101A? I'll represent to you, Dr.

16 Brookes, that this is a red line run between different versions

17 of your reports that were produced to us in discovery with the

18 newest showing up as the newest. It's a red line.

19   Do you see that?

20 **A.**   Yes.

21 **Q.**   If we turn to Page 13. This, by the way, is the standards

22 and expectations section talking about Western blotting in

23 general.

24   On page 13, we will see there is a section that was

25 removed called shared noise features between image layers. Do

1   you see that?

2   **A.**   Yes.

3   **Q.**   And toward the end it says, quantitation of the degree of

4   overlap between any two images is difficult by using image

5   enhancement techniques as described here. It can often be

6   shown that two images likely arose from a single origin if they

7   share more features than we expected by --

8   **A.**   Where exactly --

9   **THE COURT:**   Let the attorney restate the question so

10   the court reporter can get it, at least the part you were

11   reading.

12   **BY MS. BEIDEL:**

13   **Q.**   While quantitation of the degree of overlap between any

14   two images is difficult, by using image enhancement techniques

15   as described herein, it can often be shown that two images

16   likely arose from a single origin and then it continues on.

17   Do you see that?

18   **A.**   Yeah. I see where that is written.

19   **Q.**   101A?

20   **A.**   In an early draft of that document.

21   **Q.**   Why did you remove that particular sentence?

22   **A.**   I believe upon consultation with Agent Weeks and Mr.

23   Tyler, it was thought it would be a good idea to shorten this

24   document, and so this entire section was removed, including the

25   text above and below it. So it was not a choice necessarily to

1 remove just that particular sentence. It was decided to just

2 not to have a recap section so that entire thing, it was

3 thought that did not add anything to the document.

4 **Q.**   Do you still agree with your statement that quantitation

5 of the degree of overlap between any two images is difficult?

6 **A.**   Yes. Quantitation of the degree of overlap between two

7 images is difficult. Just because something is difficult does

8 not mean it's impossible.

9 **Q.**   Do you still agree that it can often be shown that two

10 images arose from a single origin, but not always. Do you

11 still agree with that?

12 **A.**   Correct. Often, but not always. Very, very few things

13 are always true.

14 **Q.**   For example, I've seen you reference as a potential,

15 quote, smoking gun that if you say duplication of two bands or

16 two blots within a paper that would be a smoking gun evidence

17 of manipulation; is that right?

18 **A.**   I believe you are referring to an e-mail in which the

19 phrase smoking gun was used and the specific criteria that was

20 mentioned there is whether the noise pattern in two white box

21 images was reproduced. That would be a smoking gun because for

22 the noise pattern and in the white box images to be reproduced

23 would be highly, highly unusual. There are, in fact, two

24 instances -- three -- sorry. Report number 4.5, report number

25 6.4 and, in fact, the original data set that I was sent

1 regarding the problem with the original data provided to the

2 Journal of Prevention of Alzheimer's Disease. Sorry. The

3 Journal of Alzheimer's Disease and Therapy. The original data.

4 In all those cases, there was, if we are going to call it a

5 smoking gun, there was -- that criteria was met which is the

6 reproduction of patterns of noise across multiple white box

7 images which is physically impossible.

8 **Q.**   And you're basing that on the background noise in the

9 image; correct?

10 **A.**   Correct. The background noise of two independently

11 generated images cannot be identifiable.

12 **Q.**   Let's look at Exhibit-106. This is your report 4.5 which

13 I believe is one of the reports you just mentioned?

14 **A.**   Correct.

15 **Q.**   If we turn to Page 5. Are you saying that the background

16 noise is repeated within the same white box and that is what is

17 impossible?

18 **A.**   In this particular instance, yes. That is noise that is

19 fuzz that is, you know, static on the television screen from

20 the old days, that is random noise. That noise should not be

21 reproduced in multiple places across an image. One possibility

22 is digital cloning of an area of an image which would lead to

23 such reproduction of the noise pattern.

24 **Q.**   So what about this versus this?

25   **THE COURT:** I'm sorry. Can you speak into the

1 microphone, please?

2 **BY MS. BEIDEL:**

3 **Q.** What about the -- I'm drawing two circles on the images.

4 One on the top portion of noise and one on the bottom. They

5 don't look the same to me. Do they look the same to you?

6 **A.** Yes. There are numerous shad features between those

7 areas.

8 **Q.** You see the same darkened line at the bottom of the top

9 line as you do the other. Do you see that in both?

10 **A.** The darkened line is different because there is an ever so

11 slightly different one pixel shift in where the box was drawn.

12 There are numerous other shad features. For example, if we

13 look, there are three little dots here. Those same three

14 little dots appear up here. There are lots of -- there is

15 another triangle of dots that appears here. That same triangle

16 of dots appears here. We can look anywhere in this image and

17 argue that the pixel level, the simple thing to do would be an

18 ORI droplet analysis to overlay these images. I would be more

19 than happy to do that, if necessary, but I think to the naked

20 eye, you can see that the noise pattern here is the same.

21 **Q.** So, for example --

22 **A.** And that is just highly, highly unusual within -- within

23 an image like this.

24 **Q.** Choosing another portion of the image at random, I have

25 just drawn a circle. Here is the other image. I see three

1 bigger dots in the top one. I don't see them in the bottom.

2 Do you see that difference?

3 **A.**   There is a slight difference in the intensity of those

4 dots, but the features above and below are the same.

5 **Q.**   So, when the differences favor your opinion, you say they

6 amount to manipulation, but when they don't, they are

7 explainable; is that right?

8 **A.**   That's not correct. That's not what I'm saying.

9 **Q.**   Are you saying that an ORI droplet would be a better

10 indication of this difference than this noise analysis?

11 **A.**   Yes. And I apologize for not including an ORI droplet in

12 this report.

13 **Q.**   But, yet, the noise analysis was a smoking gun a second

14 ago?

15 **A.**   I believe the phrase "smoking gun" was used in a different

16 time to when this report -- I would have to look at the time

17 line of when this report was used. Sorry. When this report

18 was written and submitted.

19 **Q.**   If ORI droplet analysis is the preferred technique, why

20 isn't your method just simply we did an ORI droplet analysis?

21 **A.**   There are several steps needed to get to that point. In

22 many cases, as seen here to the naked eye, it is often not

23 necessary to do the ORI droplet analysis. You can see straight

24 away that the image noise is the same or the bands are the

25 same. The ORI droplet analysis is essentially a confirmatory

1 technique to confirm something that is very often quite obvious

2 already.

3 **Q.**   There is lots of techniques either that have been

4 developed or being developed that use technology. You've

5 mentioned Photo Forensics and Image Twin as two examples;

6 right?

7 **A.**   Image Twin is one that I use quite regularly, yes.

8 **Q.**   There is others out there that are also available?

9 **A.**   There is another one that was developed by Edward Delp at

10 Perdue University in Indiana. That is I believe called Sila,

11 S-i-l-a. I actually provided some of the original data to

12 Dr. Delp for the development of that algorithm.

13 **Q.**   Are you aware of studies that test the error rate of any

14 of those algorithms? Sila or Image Twin or Photo Forensic or

15 any others?

16 **A.**   I believe is Sila one, as part of their reporting, and the

17 original paper, they conducted a false positive, false negative

18 and an error analysis in that published paper. I would have to

19 go back and read the published paper. The authors or the

20 creditors of Image Twin, I believe there have been a couple of

21 third-party reports on that in the published literature.

22 However, that is a proprietary algorithm, so I'm not aware that

23 the authors of Image Twin have published anything about its

24 effectiveness or how it works behind the scenes.

25 **Q.**   Okay. And you didn't use Sila as part of your analysis;

1   correct?

2   **A.**   No, I didn't. Shortly after the publication of that

3   paper, the website for the download, the get-up site, the Sila

4   software is essentially no longer available. For whatever

5   reason, Dr. Delp chose to pull the API. I believe he's in the

6   process of making that software available on a commercial basis

7   to journals so, therefore, probably pulled the API from getting

8   up in order to prevent it from being freely distributed.

9   **Q.**   Image Twin you did use, but you are not aware of whether

10 there is data on its accuracy because it's proprietary?

11 **A.**   I have used Image Twin. However, specifically I have not

12 used Image Twin in this case.

13 **Q.**   Oh, you didn't. Okay.

14 **A.**   The reason for that is because like a lot of AI-type

15 applications, there are privacy concerns. The files that were

16 provided to me were on a confidential basis by the government.

17 It is unclear to me when loading things in to an AI, whether

18 those images will be used in training, for example, by that AI.

19 And so none of the images that I was provided by the government

20 were sent to any third-party software AI-type platform for

21 confidentiality reasons.

22 **Q.**   Is Photo Forensic an AI tool?

23 **A.**   No. That is a simple analysis which takes place on the

24 desktop. It runs within the browser.

25 **Q.**   So you did use that tool because those AI-type concerns

1 don't apply?

2 **A.**   At the time -- in fact, I think Image Twin was launched in

3 mid-2023. I was a beta tester for it. But Image Twin and

4 other AI tools are very, very recent developments in this

5 field. At the time, when I was doing most of this analysis in

6 late 2022 and early 2023, those tools were not yet available.

7 **Q.**   But there are, as we sit here today, AI-based tools

8 available that could analyze Dr. Wang's image and as far as you

9 know, they were not used in this case?

10 **A.**   As far as I know, they were not used in this case.

11 **Q.**   Just one second. Apologies. I want to look at a few more

12 of your individual reports. Just a second here. Let's go to

13 Exhibit-130. You'll see this is one titled, origin of Western

14 blot images and figures from a particular N.I.H. grant

15 proposal. Do you see that?

16 **A.**   That's correct. This is an unnumbered report, so I

17 believe this may have been a very early example. In fact, you

18 can see the opening paragraph of this describes the introduct

19 rather than report number two as it would otherwise be referred

20 to.

21 **Q.**   So, let's look at Page 2 for a second. Just before those

22 two boxes. It says, the images appear to originate from x-ray

23 film. Do you see that?

24 **A.**   Correct.

25 **Q.**   You use that appear to language pretty frequently

1 throughout your reports. Appear to originate from some source.

2 Do you recall that?

3 **A.**   Correct. Yeah.

4 **Q.**   Why do you say that appear to originate as opposed to just

5 concluding that they do originate from the x-ray film?

6 **A.**   I base my description on what appears.

7 **Q.**   Okay. You are just doing a visual analysis essentially by

8 some tools of what appears; correct?

9 **A.**   At this stage, this is a visual analysis saying what these

10 images appear to be. You are holding a piece of film in your

11 hand. I think you can agree the size and dimensions, the fold

12 in the corner, the curved edges -- right -- these are all

13 common properties of a piece of x-ray film. So that is a

14 reasonable appearance for a piece of x-ray film.

15   **MS. BEIDEL:** Let's blow up the two pieces of film at

16 the top a bit, Ms. Blackwood. Okay.

17 **BY MS. BEIDEL:**

18 **Q.**   So, using this just as a representative example, assume

19 with me for purposes of this discussion that that white box is

20 pasted on top of what appears on the left. Okay.

21 **A.**   Correct.

22 **Q.**   Then couldn't that white box have derived from some other

23 film that accurately reflects the data that ties in to the

24 N.I.H. grant?

25 **A.**   As we have already discussed, that could be another image

1 that contains the bands in the white box image.

2 Q.   And if you are doing analyses, for example, of these top

3 two very dark blots to prove they're identical, that only

4 proves that the background on which the white box was pasted

5 matches the image on the left; correct?

6 A.   So, when you say the white boxes are pasted, are you

7 referring to the white box or the white box and everything in

8 it, or the white box and the bands in the white box, but not

9 the noise in the white box? Is that what you are referring to

10 when you say it was copied and pasted?

11 Q.   What I meant to refer to is the entire white box and all

12 of its content including the noise and the bands.

13 A.   It is not possible that the entire white box could had

14 been pasted in. If that were to be the case, it would obscure

15 the noise from the original raw image and yet what we see here

16 is a scene in many of the reports: The noise in the raw image

17 appears again in the white box image.

18   So simply pasting those bands on top is impossible to see

19 how the underlying noise would come through to show up in the

20 final image.

21 Q.   Couldn't the white box have derived from a different

22 exposure of those same two?

23 A.   As we have already mentioned, different exposures show up

24 on different pieces of film. These are the same piece of film.

25 Q.   Not if the white box is pasted on top. It could have come

1 from a different piece of film in that scenario?

2 **A.**   The white box could have come from another piece of film,

3 but then it would bring with it the noise from that piece of

4 film and would not show the noise from the raw piece of image

5 on the left.

6 **Q.**   I'm going to switch the document camera for a second. I'm

7 showing the film that is contained within Exhibit-52. I

8 believe what you told me is these are all different exposure

9 times of the same two pieces of film; is that right?

10 **A.**   Correct. So, if you move the document down a little bit,

11 you can see in the top corner it says 60 seconds. On the other

12 side it says 30 seconds written backwards, so the film was

13 flipped to collect those different exposure times.

14 **Q.**   So the one on the right was exposed for 30 seconds and the

15 one on the left was exposed for 60 seconds, but it's otherwise

16 the same?

17 **A.**   Correct. Correct.

18 **Q.**   And you see this dot right here?

19 **A.**   Correct.

20 **Q.**   And it appears over here; correct?

21 **A.**   Correct.

22 **Q.**   And this could just as easily been two separate pieces of

23 film as it is one film with two blots?

24 **A.**   It could be two separate pieces of film. However,

25 positioning that film some people do sometimes cut the film up

1 into numerous pieces. So positioning the film in exactly the

2 same place in the cassette when you have numerous little, small

3 pieces of film, is -- is very very difficult to do properly.

4 **Q.**   Assume we did have two little pieces of film, that

5 background noise would match, even though these are different

6 exposures, wouldn't it?

7 **A.**   It would in terms of these being different exposures,

8 correct.

9 **Q.**   So, if there was a --

10 **A.**   What I have done is to collect these exposures, and so the

11 raw data is self-contained within one of those pieces of film.

12 There would be absolutely no scientific reason for me to have

13 one exposure of a piece of film and then to take the set of

14 bands and to transpose that set of bands on top of another

15 piece of film containing noise and then to merge those images

16 in order to maintain some of the noise, but some of the bands

17 but different bits of each image. That is not how Western

18 blots are done. That also still does not answer the issue of

19 where is the raw data and the original image from which the

20 bands in the white box appeared.

21 **Q.**   But it's possible for noise to match between two different

22 exposures; correct?

23 **A.**   It's possible for noise to match between two different

24 exposures. It is not possible, as we discussed, for noise to

25 match between, say, stripping and reprobing. But different

1 exposure of the same blot within a few seconds of each over, I

2 put a piece of film down, take an exposure, flip it around,

3 take a second exposure, that can sometimes lead to the same

4 noise pattern.

5 **Q.**   So, if the white box derived from a different exposure of

6 the two blots on the bottom of the left image and then those

7 were pasted on top of that image, isn't it possible that the

8 noise remnants came from that different exposure?

9 **A.**   It would be highly unusual because what you see here is

10 the white box image has a very very clean background. The

11 white box image is brighter than the film behind it, so the

12 film behind it is sort of a muted gray. Just all of this stuff

13 is gray.

14   So the white box image being much brighter. When an image

15 is brightened, the noise should become less prominent. So, it

16 would be very unusual for the white box to come over in a much

17 brighter format with the bands and yet the noise comes over

18 darker.

19   The most logical explanation here is that the noise

20 originated from the raw image on the left because the noise in

21 that image is much darker and more prominent to begin with, so

22 pasting a very light-colored image on top of a dark-colored

23 image, the dark image is going to be the prominent source of

24 noise in that image.

25 **Q.**   When you say the most likely --

1 **A.**   Again, it is infeasible scientifically as to why anybody

2 would choose to prepare an image in this way.

3 **Q.**   When you say the most likely explanation, you mean

4 51 percent?

5 **A.**   No. I mean, the likely explanation for the appearance of

6 the noise in the white box image is that this noise comes from

7 taking the raw image on the right and brightening a particular

8 section of that image resulting in the appearance of the light

9 noise patterns which are seen in the white box image, for

10 example, this here.

11 **Q.**   But it's possible that it came from a different exposure,

12 just not likely in your explanation?

13 **A.**   It is possible, but highly, highly, highly unlikely that

14 the bands here and the informational content of the white box

15 image, it is possible that that came from another unknown

16 source. We were not provided with -- with those images if they

17 exist. It is also, it should be reiterated when thinking about

18 the reverse and the scientific chain of provenance and custody,

19 that other exposure, if it exists, is those are the bands that

20 appear in the final paper. That other exposure should had been

21 the piece of film that was retained. That is the raw data for

22 that image and yet, that raw data does not appear to exist.

23 **Q.**   Do you --

24 **A.**   What we have instead is another piece of film which

25 appears to share some noise, but does not contain the bands.

1 **Q.**   Do you know how Special Agent Weeks obtained these films

2 that he provided to you or blots that he provided to you?

3 **A.**   I don't know. These are digital images. They're JPEGs.

4 My understanding is that Agent Weeks obtained them as JPEGs.

5 **Q.**   You don't know whether he, for example, executed a search

6 warrant at CUNY and obtained everything available in Dr. Wang's

7 lab?

8 **A.**   I don't know. That's beyond my involvement in this case.

9 **Q.**   There could easily be other records, other devices, other

10 digital images available in that lab and you would not be aware

11 of it; correct?

12 **A.**   There may be. I'm not aware if such resources exist.

13 **Q.**   You do know that CUNY was conducting its own internal

14 investigation; correct?

15 **A.**   Yes. I already mentioned that, yes.

16 **Q.**   Do you know whether they obtained files from Dr. Wang's

17 lab at any point?

18 **A.**   I don't. I would say that it is typical during

19 investigations for institutions to request the files and other

20 materials from laboratories.

21 **Q.**   Do you know whether it's possible that CUNY took some of

22 those files and never returned them in a way that they were

23 available to Special Agent Weeks?

24 **A.**   I don't know the timeline in which any files were taken or

25 obtained so, again, this -- that is beyond my involvement in

1 this case. All I can do is base my analysis upon the materials

2 that I was provided with.

3 **Q.**   What you are doing, though, is saying that, in your view,

4 it would be standard scientific practice for Dr. Wang to have

5 retained these other films, if they exist; correct?

6 **A.**   Correct.

7 **Q.**   Isn't it true that you don't know one way or another, as

8 you sit here today, whether Dr. Wang retained those films?

9 **A.**   Correct.

10 **Q.**   So isn't your entire opinion based on the premise that

11 there are no other films so that there is image manipulation

12 based on the images that you saw only?

13 **A.**   Can you repeat the question?

14 **Q.**   I can, and hopefully I will do it better this time.

15   Isn't your entire opinion based on the comparison of the

16 images that Special Agent Weeks provided you with only and

17 completely to the exclusion of any other images, if they exist?

18 **A.**   My opinions and conclusions are based on the images that I

19 was provided with. What I can conclude, for example, is that

20 in numerous cases the bands pattern in the white box image and

21 the final published image does not find any provenance in the

22 raw image. That is the extent of my conclusions.

23 **Q.**   Let's go back to Exhibit-130, which we were looking at a

24 second ago, Page 18?

25   **THE COURT:** So, Ms. Beidel, it's now one o'clock. I

1 think we are going to have to take a lunch break.

2   **MS. BEIDEL:** I'm almost finished, I think, Your

3 Honor. I was going to ask like two more questions and then

4 consult with my client to see if he had anything else and I can

5 wrap up if that works for you.

6   **THE COURT:** With the caveat that, I've never had a

7 lawyer say two more or one more question and actually stick to

8 it, we can go two more minutes.

9   **MS. BEIDEL:** Thank you, Your Honor.

10 **BY MS. BEIDEL:**

11 **Q.** You will see in the last paragraph here it starts with, in

12 the absence of exculpatory evidence, e.g., original blot films

13 with lower exposure that, indeed, show that the ends of

14 interest at 90 kilodaltons and 280 kilodaltons as they appear

15 in the proposal figures, it is my professional opinion that the

16 figures as presented in the proposal are fabrications.

17   Do you see that?

18 **A.** Yes.

19 **Q.** Do you still agree with that as you sit here today?

20 **A.** Yes. I agree with that opinion as expressed in this

21 document.

22 **Q.** So, if there were exculpatory evidence, e.g., original

23 blot films with a lower exposure that showed the bands, then

24 you would change your opinion; correct?

25 **A.** I would change my opinion if such evidence became

1 available.

2   **MS. BEIDEL:** One second, Your Honor.

3   We can take that down, Ms. Blackwood.

4   One question from Dr. Wang and I'm going to stick to my

5 deal with you.

6 **BY MS. BEIDEL:**

7 **Q.**   We have seen film example that's a whole 8-by-11 sheet;

8 correct?

9 **A.**   Yes.

10 **Q.**   Is it possible to use films for Western blots that are

11 smaller, you know, a strip that shows two blots, for example?

12 **A.**   It can be common to cut up pieces of film in to smaller

13 sizes. There is a limit to how small those can get because the

14 film eventually has to be fed into a developer machine. And if

15 the film is too small, there is quite literally a risk that it

16 get lost inside the machine because it's too small for the

17 rollers inside the machine to handle. So there is a lower

18 limit of roughly a third of a piece of film. Any smaller than

19 that, you can't feed the film in to the developer machine.

20   **MS. BEIDEL:** One more second.

21 **BY MS. BEIDEL:**

22 **Q.**   If you are using small strips of film, could they be taped

23 on top of a larger piece of film for purposes of development in

24 that process you just discussed?

25 **A.**   No. You would break the developer machine. The developer

1 machine can only handle one piece of film at a time. In fact,

2 a common mistake that's made is the box of film comes with a

3 piece of cardboard, the first piece, and it's a common rookie

4 mistake to accidentally feed the piece of cardboard into the

5 machine. If you feed anything other than one piece of film at

6 a time into the Western blot developer, you will break the

7 developer machine and end up with a $30,000 bill from your

8 department chair. So that's not good.

9 **Q.**   Well, that's not good. There could be a strip that's

10 maybe a third of a sheet is a fair size?

11 **A.**   There could be a piece of film which is a third of a piece

12 of film. However, as you see in many cases, many of the white

13 box areas were two by three centimeters which is simply way too

14 small to feed into any type of developer machine without

15 breaking the machine.

16   **MS. BEIDEL:** Nothing further, Your Honor.

17   **THE COURT:** So, Mr. Tyler, where are we now? Do we

18 have any redirect?

19   **MR. TYLER:** I think just one point I would like to

20 clean up. Is that acceptable?

21   **THE COURT:** You are testing the patience of -- not

22 just me, but staff. We have been at this -- it's a lunch hour.

23 So how many questions?

24   **MR. TYLER:** Just a few questions just to try to clean

25 up one thing.

1   **THE COURT:** Okay. Go ahead.

2   **MR. TYLER:** Ms. Cornich, could you pull up

3   Exhibit-5A?

4   **REDIRECT EXAMINATION**

5   **BY MR. TYLER:**

6   **Q.**   Dr. Brookes, when Ms. Beidel was asking you about assumed

7   images and other images that may exist, during our direct

8   examination this is one image. If we go to Page 6 here,

9   please. We matched up the boxes here on this particular image

10   and I think with respect to any additional images, would those

11   have to be digital images or film image based on the analysis

12   that you did here?

13   **A.**   The superimposed images would have to be digital because

14   the noise is digital. The noise between the raw and the white

15   box image is digital, so anything that is pasted in here has to

16   be digital.

17   **MR. TYLER:** Okay. No further questions, Your Honor.

18   **THE COURT:** Okay. Anything else just on that?

19   **MS. BEIDEL:** No, Your Honor. Thank you.

20   **THE COURT:** Okay. Could I just ask one question,

21   possibly more. Just to clarify, since we talked about this

22   noise analysis of what is in the background of one image versus

23   another. Is there any known or any established standard on how

24   many or how many points of comparison between one image and

25   another that you would need to see to determine whether the

1 background noise means that they are the same or that they are

2 not? Is there any established industry, but sort of scientific

3 standard has been adopted across the community?

4   **THE WITNESS:** Insofar as this is a field, it's a very

5 young developing field, the standards have not yet really been

6 defined. There are some standards from other types of image

7 analysis in the scientific field. For example, with

8 fluorescent microscopy you may have an image of some cells and

9 you may have two proteins and you want to show whether those

10 two proteins overlap on a microscope, that can be done with

11 very sophisticated software which most people do not have

12 access to which is essentially provided by the people that sell

13 the microscope.

14   So, if you have a Leica microscope, that's about a half a

15 million dollar microscope, that comes with a proprietary

16 software package that will enable you to line up images and say

17 this image and this image overlap by 94.3 percent and put a

18 number on a pixel basis. That is not software that is commonly

19 available. That can be done, but my lab typically does not use

20 fluorescent microscopy. I know of only one other lab in my

21 university that has access to that type of equipment and

22 software.

23   So it's not something that, for example, Elizabeth Bik or

24 other people operating in this area would have access to.

25   **THE COURT:** Second question on this. ORI, do they

1   have any tools that help, are available to do that kind of

2   comparison? I know they have the droplets, but the droplets

3   seem to be for something else.

4   **THE WITNESS:** Yeah. The ORI, as far as I know, does

5   not make available a quantitation tool such as that.

6   **THE COURT:** Okay. Thank you. Anybody want to follow

7   up on that they can.

8   **MR. TYLER:** Nothing from me, Your Honor.

9   **MS. BEIDEL:** No, Your Honor. Thank you.

10   **THE COURT:** Thank you very much, Dr. Brookes. We

11 appreciate you testifying. I know it was a long morning in to

12 the afternoon. So you can step out now.

13   (Witness excused.)

14   - - -

15   **THE COURT:** So what we are going to need to do from a

16 scheduling standpoint is we will take a lunch break. I believe

17 we have a -- let me just check. We have a sentencing at 2:30,

18 but I would like to hear from counsel on these issues after

19 lunch and I don't think Dr. Brookes needs to be here unless

20 anyone thinks we might need him again. I know he has a

21 conflict at some point in the afternoon. We could perhaps come

22 back -- again, I want to make sure the staff gets a sufficient

23 break, but I'm willing to come back at let's say ten minutes to

24 two and see what we can accomplish before the 2:30 sentencing

25 and let's see where we are.

1   Is that okay with everyone?

2   **MR. TYLER:** It is for the government, Your Honor.

3   **MS. BEIDEL:** Yes, Your Honor.

4   **THE COURT:** I take it there is no further questions

5   at this point, even though I think I had mentioned indirectly

6   that the defense experts were still in the picture but,

7   obviously, there is some connection between what happens to Dr.

8   Brookes' testimony and them, so we are starting here. So I'll

9   see you at 1:50.

10   **MS. BEIDEL:** Thank you, Your Honor.

11   **DEPUTY CLERK:** All rise. This Honorable Court now

12   stands in recess.

13   (Whereupon, a lunch recess was taken from 1:11 until 1:54

14   p.m.)

15   **DEPUTY CLERK:** All rise. This Honorable Court

16   resumes in session. The Honorable Theodore D. Chuang

17   presiding.

18   **THE COURT:** Thank you, everyone. Please be seated.

19   So my thought was that on the one hand the defense has filed a

20   motion to exclude Dr. Brookes, but I think I might want to

21   start by asking questions of the government just to understand

22   the scope of the opinions that you are actually planning to

23   offer at trial.

24   As I read it, there is a lot of reports from Dr. Brookes,

25   and now I am finding out from the testimony that some of them

1 might have been sort of drafts or earlier versions, and I know

2 there is some I never even got, which is fine up until now.

3   I want to get a handle on what exactly the testimony would

4 be and then we can see who is in the best position to argue

5 about it from there.

6   So, Mr. Tyler, maybe you can give me -- usually like in an

7 easy situation you just have like one expert report that lists

8 like five things, and that's what we are going to hear, no more

9 and no less.

10   Can you distill for us now what you expect him to testify

11 about?

12   **MR. TYLER:** Yeah. So we -- I think also was probably

13 something the defense raised, Ms. Beidel raised earlier, is we

14 don't expect any of his testimony to sort of like be outside of

15 the bounds of the exhibits that were admitted today.

16   Now, there are a lot of reports in there that we didn't

17 have time to go over, but a lot of them are repetitive in the

18 sense that there is like the reverse analysis, the forward

19 analysis, and like that is very similar to what we did in court

20 today. And it is just for a cross -- I think it's like 13 or

21 14 unique images across the entire case like some of them are

22 viewed across multiple grants and multiple papers.

23   But the reason that we, frankly, did some of those other

24 vignettes afterwards was to show some of the other pieces that

25 are sort of in that third part of his analysis where he found

1 something else out.

2   So I think we covered substantively -- I can't say this

3 absolutely, but I think we covered almost all substantively of

4 what the different types of analysis are that are sprinkled

5 through the reports with like, for example, reverse analysis

6 would be repeated in basically all 13 of the images, and the

7 same with the forward analysis. And then the extra pieces of

8 analysis just depends on whether it was available for that

9 particular image or not.

10   **THE COURT:** So how many different images are there?

11 Thirteen?

12   **MR. TYLER:** I don't have it pulled up right in front

13 of me, but that is right around there, yes, Your Honor.

14   **THE COURT:** Going in to trial, it would be helpful

15 for me to understand -- and we don't have to do this today, but

16 even though it might be in these binders, it would be helpful

17 for me to know if he's going to testify about 13 different

18 images, are there 13 different reports and just looking at the

19 final versions, at least that's what I would start with. I

20 understand maybe there is some arguments to be made if things

21 have changed over time. Are there four images that are covered

22 in a single report? It would be good to have sort of what we

23 think is the expert report regarding those 13 images, whether

24 it's 13 different reports or some smaller number.

25   **MR. TYLER:** Yeah. It's going to be -- it's going to

1 be 13 -- it's going to be at least 13. Each report

2 essentially -- actually it might be more than 13 because some

3 of the images --

4   **THE COURT:**   Thirteen images or 13 reports or both?

5   **MR. TYLER:**   Thirteen -- it's going to be 13 images.

6 It's going to be more than that number of reports. I don't

7 have that right in front of me.

8   One thing that Your Honor might -- what might be helpful,

9 you may recall back in I think December we filed I think under

10 seal a summary of all the different images in each of the

11 grants. That is -- those are the same figures with one

12 exception. There is one additional figure that we notified the

13 defense about, but that is -- those are all the figures in each

14 of the grants that we're going to cover.

15   **THE COURT:**   Do you have the ECF number for that?   It

16 was kind of a while ago.

17   **MR. TYLER:**   Yeah. Exhibit-68. It's the exhibit to

18 ECF 68.

19   **THE COURT:**   We will go back and look at that.

20   So there is these 13 different documents. At some point,

21 by the way, it would be helpful to get a little chart with like

22 which report goes with which and maybe even getting all the

23 reports together because the reports probably aren't really

24 evidence, but they are going to be useful for everyone.

25 Probably the subject of cross-examination, if nothing else.

1   So, for each of those, there is at least the potential for

2   Dr. Brookes to testify about how there is three pieces, the raw

3   data slide, the white box thing and then the published version.

4   **MR. TYLER:** Correct.

5   **THE COURT:** And he wants to be able to say that --

6   well, actually can you just clarify for me the white box thing?

7   I'm not sure -- I was a little bit surprised by Dr. Brookes'

8   answer. It sounds as if nobody does white boxes. This is the

9   only time that's ever happened.

10   Can you just explain what your understanding of the white

11 boxes are?

12   **MR. TYLER:** Yes.

13   **THE COURT:** The defense may have a different view,

14 but go ahead.

15   **MR. TYLER:** I imagine defense does have a different

16 view.

17   Our understanding is that like if you are going to do

18 image analysis, I think Dr. Brookes was trying to describe, is

19 like if you are going to do that, you do that across the entire

20 blot, and so seeing like these little pieces is not

21 something -- it's not something we have seen in the people that

22 we have talked to as a common practice for any of the people.

23   **THE COURT:** But none of them were considered final

24 images; right?

25   **MR. TYLER:** That -- I mean --

1   **THE COURT:** What we call the white box document?

2   **MR. TYLER:** So usually they are like -- if you look

3   at the white box, that is usually directly transferable to the

4   final image. Like it appears that that is like essentially

5   like cropped and then put into the final image.

6   **THE COURT:** So one opinion is that those are the

7   same. Another is that the white box and the so-called raw

8   document derive from the same place. Less from the blots, but

9   from this background noise concept. And the third piece is

10   that the blots in the white box can't really be replicated or

11   created based on the raw image.

12   **MR. TYLER:** Yes. That is all -- all true. The

13   third -- the one caveat is the third scenario, what he calls

14   his third step is really some of the other stuff we covered

15   where, in other words, where there is 12 bands instead of --

16   his third step of the analysis is there is some other feature

17   that he's noticed that like is usually specific to that

18   particular analysis, like there is 12 bands instead of 13 and

19   there is like -- there is like multiple images that correspond

20   to the same raw image.

21   So those -- I do think we hit most of those today in the

22   testimony, so those pieces are going to be a little bit more --

23   **THE COURT:** Do those come up multiple times? You

24   just gave me one example, or do they only come up once each?

25   **MR. TYLER:** Most of those only come up once each.

1   **THE COURT:** One was, for example, the 12 and 13. One

2   was sort of the shape of the --

3   **MR. TYLER:** Yeah. The 12 and 13 only comes up once.

4   **THE COURT:** The shape of the band?

5   **MR. TYLER:** Yes. The shape of the band --

6   **THE COURT:** What about this pH scale issue?

7   **MR. TYLER:** That also only comes up once.

8   **THE COURT:** And then what about this terminal digit

9   argument?

10   **MR. TYLER:** Yeah. That also only comes up -- well,

11 there might be a couple other -- he makes the same analysis on

12 different sets of data, but it's the same -- it's the same.

13 You take data inputs and then you do the statistical.

14   **THE COURT:** But are you going to have him testify

15 about data that is not directly associated with one of these

16 images? Are we going off in another area, or is it just data

17 that connects to the images?

18   **MR. TYLER:** So this -- so this is like a little -- so

19 simply the one he talked about today was tied to a particular

20 journal article. I don't remember -- there is a number of

21 figures in that article that are also repeated N.I.H. grants,

22 but I do not think all of them are.

23   So that is -- that is -- I'm just trying to be totally

24 transparent about my understanding of that.

25   **THE COURT:** When you say "figures," you are talking

1 about the images, not the data numbers?

2   **MR. TYLER:** Sorry, Your Honor. In other words, if

3 you have a journal article with 13 figures in it, maybe six of

4 them are ones that are also like essentially also appear in a

5 grant application, and that terminal digit that houses was

6 against all 13 in the actual -- in that actual article.

7   **THE COURT:** Okay. Then when he's talking about data,

8 whether it's relating to the terminal digits or the pH scale, I

9 was not at all aware of this issue about pulling up data from

10 the PowerPoint presentation -- PowerPoint I guess if you -- is

11 this how this works? Is that you have a spreadsheet and you

12 ask PowerPoint to make a graph basically?

13   **MR. TYLER:** Yes.

14   **THE COURT:** So it's the underlying data?

15   **MR. TYLER:** Correct.

16   **THE COURT:** Is all the data in that form, or is some

17 of it just in some other freestanding set of data?

18   **MR. TYLER:** So, I mean, it's in both. Right.

19 Because the PowerPoint -- basically the PowerPoint has the

20 chart embedded in it. Within that chart, what we tried to show

21 was that you can basically unpack the Excel that is the input

22 for that chart, and so that -- like that was that extraction I

23 tried to show. We can think more about how we can present that

24 at trial. Frankly, some of it could probably be done through

25 testimony, but that's -- the idea is that the PowerPoint has a

1 chart in it and within that chart is embedded data that is the

2 source for the chart.

3   **THE COURT:** And that's the only data we are going to

4 be talking about, things from those spreadsheets?

5   **MR. TYLER:** Yeah. That's correct.

6   **THE COURT:** How many different images does that come

7 in to play on?

8   **MR. TYLER:** So it comes in for figure one and then

9 there is an additional spreadsheet which I think is in our

10 exhibit list as 22, and that one has an additional four figures

11 in it as well, so spreadsheets associated with four figures.

12   **THE COURT:** So 5 out of 13?

13   **MR. TYLER:** Correct.

14   **THE COURT:** You are looking at the data?

15   **MR. TYLER:** Correct.

16   **THE COURT:** Again, the two categories I'm familiar

17 with is this terminal digit issue and the pH scale, but I think

18 he talked about some other problems he had with data, but they

19 seemed very sort of targeted.

20   **MR. TYLER:** Yeah. The other -- so the other data

21 thing I think is actually where he referred to the fact that

22 the 12 and the 13 didn't match the data, that has actually --

23 comes back to that spreadsheet in Exhibit-22 and that

24 particular figure is -- has been extracted into this

25 spreadsheet here in Exhibit-22.

1   **THE COURT:** Okay. I think I understand.

2   And then is his proposed opinion on these things that

3   these figures are fabricated or that they're different from the

4   raw data that they can't be traced back? What do you want him

5   to be able to say?

6   **MR. TYLER:** I mean, I think our preference would be

7   like he says all of those things, like they are sort of

8   building blocks. First he says they match and then, you know,

9   they can't be traced and then he says that the -- that it

10   doesn't -- the research record doesn't match the underlying

11   data, and then he says, it's fabricated. Our preference would

12   be to do all of that.

13   **THE COURT:** Okay. So I'll come back to you now that

14   we know what we are dealing with. Let me go to Ms. Beidel

15   since it's her motion as to what issues she wants to discuss,

16   how and if we should be excluding anything here.

17   **MR. TYLER:** Your Honor, I've been informed that it's

18   33 reports tracked back to the 13 -- back to the 13 images.

19   **THE COURT:** When you say "33 reports," are they --

20   those cover the opinions, but do those include sort of drafts

21   of the same report?

22   **MR. TYLER:** No. Those are --

23   **THE COURT:** Thirty-three final reports?

24   **MR. TYLER:** Yes. And that is what was introduced

25   today was all the final reports. Obviously, we produced the

1 other reports.

2   THE COURT: Okay.

3   MS. BEIDEL: Your Honor, first of all, with respect

4 to the number of images and the number of reports, this is

5 something we flagged with the motion to dismiss stage that I'll

6 raise again.

7   The indictment discusses proposal one and proposal two

8 which deal with, as far as I understand it, only figure one

9 from grant one and figure one from grant five. There have not

10 been any 404(b) notices regarding these other figures. As I

11 understand the counts, they are about discrete conduct, so in

12 the defense's view, one narrowing that can and should happen is

13 that the government should be presenting evidence about the

14 items that were contained in the indictment as the allegations

15 and not all of these other images, that as far as I know, have

16 only been listed on that preliminary list, but never noticed

17 for any purpose through a 404(b) notice or otherwise.

18   THE COURT: So I'm looking at the indictment. It

19 references five grants, doesn't it, or not?

20   MS. BEIDEL: It does, but if you look at the language

21 of the counts, in each of the counts, there is a discrete

22 reference to one and only one proposal and between the four

23 counts, there is proposal one and proposal two which gets them

24 only two figures out of this set of images.

25   THE COURT: Are you saying that the -- I don't know

1 how many we are talking about -- the 13 images go beyond one

2 and two. Do they also go beyond the five grants that are

3 referenced?

4   **MS. BEIDEL:** They do not go beyond the five grants.

5   **THE COURT:** They are all within the five grants.

6   **MS. BEIDEL:** Proposal one and proposal two are

7 subsets of grant one and grant five. And then the remainder

8 are the rest of grant one and grant five.

9   **THE COURT:** Okay.

10   **MS. BEIDEL:** Moving on to the Daubert argument, Your

11 Honor, the standard for expert testimony, of course,

12 scientific, technical or specialized knowledge that will help

13 the trier of fact. The big indicia of that is it based on

14 sufficient facts and data, are they applying reliable methods

15 and have they between applied appropriately in this case.

16   First on the sufficient facts and data here. Dr. Brookes

17 just isn't in a position to know one way or another whether

18 there are other images that Dr. Wang preserved or not. Did

19 CUNY destroy them or move them? Are there other intervening

20 factors? How thorough was the government's collection?

21   A lot of his testimony turns on really the absence of

22 these images, so without acknowledge as to why that absence

23 exists, he's drawing conclusions based on an incomplete data

24 stat, and he does not know the reason for that incompleteness,

25 and I think that's a fundamental flaw in the data and facts of

1 all of his opinions are based on.

2   As to reliability --

3   **THE COURT:** Before you get to that, let me ask: The

4 ones he's calling the raw images --

5   **MS. BEIDEL:** Yes.

6   **THE COURT:** -- do you acknowledge that they were, at

7 least, things that Dr. Wang generated? Maybe they weren't the

8 real raw image, but they are connected to this research in a

9 way that it's a comparison is kind of -- not a crazy thing to

10 do?

11   **MS. BEIDEL:** Yes.

12   **THE COURT:** You can compare this. You might argue,

13 well, that's the wrong image, but it's part of a sequence of

14 images that at least it's a legitimate thing to do.

15   **MS. BEIDEL:** We are not contesting the visual

16 similarities between the two sets of images that Dr. Brookes is

17 flagging in terms of the background around the white boxes.

18   **THE COURT:** When you say "similarities," are you

19 saying you are not contesting they are similar, or that you are

20 not contesting that they are identical or clearly not the same,

21 which seems to be what he's saying?

22   **MS. BEIDEL:** We are not contesting that they are

23 clearly the same in some ways. There is handwriting that is

24 the same as between some of them, for example. Our position, I

25 think, is what came out on cross, that there are other images

1 that are different exposures or that have been stripped and

2 reprobed or some other analysis has been done to them that were

3 the digital images that form the basis for the white boxes and

4 then that those white boxes were cut and pasted by Dr. Wang on

5 top of what Dr. Brookes calls the raw image as a sort of

6 Ladenol look. That's how Dr. Wang maintained a record of which

7 lanes in particular the white boxes derive from.

8   It's important to keep in context that this is all

9 clinical research with lots of different participants and

10 different treatment values, so there is a lot of data to keep

11 track of. It's not just we are looking at 33 images or 33

12 reports and 13 images, but he was doing thousands and thousands

13 of Western blots a year. And so as that image is sort of

14 developed into the final, it was important to keep it somewhere

15 that he knew where it derived from. So he put it over that,

16 otherwise, useless raw data.

17   **THE COURT:** Otherwise, useless raw data from some

18 other test?

19   **MS. BEIDEL:** From the same test, but a different

20 exposure or a different -- it wasn't stripped and reprobed.

21 Some kind of different treatment that made that test not the

22 ideal visual representation of data.

23   So what the exposures do is essentially made the

24 representations of the data more palatable for publication.

25 You might have a super dark one that you can't use. You might

 1 have a super light one that you can't use. The scientists sort

 2 of nuance that exposure time to get to the ideal, and that's

 3 what we are talking about here. Yes. It derived from the same

 4 data, but it's not the actual original that should be used in

 5 Dr. Brookes' analysis and, frankly, I don't think he can say --

 6 he testified that he can't rule out that possibility. In a

 7 case where the burden of proof is beyond a reasonable doubt,

 8 that kind of opinion just is not helpful to the trier of fact.

 9   Moving on to the Daubert factors, there is no indication

10 that this image analysis methodology that he's developed and,

11 frankly, that he says is a young developing field with

12 undefined standards, there is no indication that it's been

13 tested in any kind of thorough way. There is no rate of error

14 we can assign to this kind of methodology as applied to a

15 particular Western blot images. There is no type of peer

16 review process that the government or Dr. Brookes has pointed

17 to in support of his method.

18   What there is is a handful of publications that Dr.

19 Brookes himself authored with no coauthors talking about

20 methods of image analysis, but not exactly the same methods as

21 the ones that are applied here.

22   Just because image analysis exists as a concept somewhere

23 in the scientific community does not mean that this three-stage

24 pipeline with eight other assorted scientific testing methods

25 is the correct way to do image analysis certainly in a criminal

1   case.

2   The government hasn't pointed to a single case where this

3   method has been analyzed or applied. There are some ORI

4   decisions affirming administrative decisions from ORI, but they

5   do not assess at all the substance of the methodology.

6   **THE COURT:** So the things I have from the ORI, I

7   think in the record, are just sort of what they did -- what the

8   result of the analysis was. They don't really speak to what

9   the analysis that they went through was, do they?

10   **MS. BEIDEL:** Not that I'm aware of, Your Honor. So

11 as far as I know, there is not a court anywhere in the country,

12 civil or criminal, that has ever been asked this question

13 before, that has been put to the test of whether this is

14 reliable evidence.

15   So, for it to be for the first time applied in a criminal

16 proceeding such as this where Dr. Brookes, frankly, gave a lot

17 of opinions about what was the scientific standard that were

18 not based on the records, that were just based on his

19 experience. This is the standard for this, for that or the

20 other thing. That's dangerous to the trier of fact.

21   **THE COURT:** So let me ask: He lists about eight

22 different forensic methods. Assuming for the sake of argument

23 I agree with you. Maybe this full methodology has never been

24 tested, never been reviewed. No one has any idea how often

25 errors are made with it. Some of these individual techniques

1 whether it's using this Photoshop curves thing or the

2 brightness in contrast on -- I don't know if that was on

3 PowerPoint or something, Adobe, or using this ORI droplet

4 product that ORI itself I think puts out there, do you see any

5 problem with using those techniques in the sense that that

6 technology is inaccurate for some reason, or are you okay with

7 the idea that anyone can do that the way someone can perhaps

8 show, put something under a black light or something, or do

9 something else to sort of enhance how you look at it. And it's

10 really more about what conclusions you draw from it than it is

11 from the use of the technology.

12   **MS. BEIDEL:** I don't think we're in a position to

13 contest the individual techniques. We were looking at this as

14 a method. You know, what Dr. Brookes' testimony is, as I

15 understand it, is that to conduct this analysis as he feels

16 comfortable with it it requires all of the steps and all of the

17 methods, so I'm not sure whether he would say, for example,

18 that one, if you took out one method, the histogram analysis,

19 for example, that that would be sufficient or helpful to the

20 jury. I don't know the answer to that because that wasn't the

21 particular way that he framed his opinions here.

22   What I do know is that there are some AI tools being

23 developed that can be used to either corroborate or not the

24 conclusions here. Some of the relevant --

25   **THE COURT:** I think we are probably a really long way

1 from taking an AI tool and saying that's reliable scientific

2 evidence, at least that's how I look at it.

3   **MS. BEIDEL:** Understood, Your Honor.

4   **THE COURT:** But you are saying we don't even have

5 that here?

6   **MS. BEIDEL:** Some of the journals in play here, if

7 you analyze Dr. Wang's work, use those tools and cleared his

8 work.

9   So, at a minimum, I think a reliable method of analysis

10 would take into account that work that was done, consider

11 whether, you know, as a factor it should be replicated and then

12 factored into the decision making.

13   There is also no forensic analysis conducted here, as Dr.

14 Brookes suggested. There are a lot of cases in the criminal

15 realm, child pornography, for example, that talk about the

16 value of doing MD5 hash analysis to make sure that the images

17 that you are talking about trace through forensically.

18   As far as I know, the government doesn't have some other

19 witness to do that to. Their case rises and falls on Dr.

20 Brookes, and it's all about Dr. Brookes saying -- I looked at

21 these images. I don't really know how they were derived. I

22 don't know if they are a complete set of data or not, but I am

23 reaching the conclusion that they either match or don't match

24 using these tools.

25   That's all that there is. And I think in other types of

1 case law like child pornography cases, for example, that would

2 not be enough for a Court to find that there is a forensic

3 match between the images.

4   **THE COURT:** So no. Okay. I just want to follow up

5 on that. So the -- again, these tools, the various tools, some

6 are probably more accepted than others, whether it's the ORI

7 droplets or change the contrast on something. The histogram

8 thing, I'm not sure I've seen that discussed in the literature,

9 but the individual tools, it sounds like your view as well. If

10 someone wants to apply those tools and some of them are

11 commercially available, they can do that. It probably doesn't

12 require -- at least in my view, it may not require sort of peer

13 review of, you know, changing the contrast or something to get

14 something to look right. Maybe not.

15   But you are concerned that if you look at those things

16 either together or separately and reach the conclusion that

17 it's fabricated or something like that, that's where you say it

18 hasn't been tested to that level of analysis?

19   **MS. BEIDEL:** Yes. And adding an expert opinion on

20 top of that. So, for example, if we talk about brightness and

21 contrast I think is a good example.

22   If the government wanted to go into Photoshop and use

23 brightness and contrast to adjust one of the images to

24 80 percent, and then put up a slide in closing arguments that

25 compares those two images, and make an argument to the jury

1 about whether they match or not and whatever that means, we

2 don't have a problem with that. We could make the

3 counter-argument to that.

4   My problem is where Dr. Brookes comes in with the

5 imprimatur and the PhD from Cambridge and espouses this method

6 as if it's, you know, you went in to any lab in the country,

7 and you would find that this was a generally accepted method.

8 And he says these images are fabricated. We're replacing a

9 jury's role with his role, frankly. He presents well.

10   You know, I struggle to see what jury would listen to the

11 way that he presents that with the level of conclusion he's

12 willing to reach about what's accepted and what is not in the

13 scientific community and sort of dare to differ with it,

14 frankly.

15   **THE COURT:** So, what if he got up there and said,

16 look, I have looked at these side-by-side documents, and here

17 is some side-by-side images I put together using some of these

18 tools, whether the brightness and contrast, or the color

19 gradient, and so now you can kind of see with this color how

20 similar they look, how different they look. And so here is

21 what I generated through these things and also to some degree

22 I'm going to point out these two things kind of match up on

23 both screens, these things look different, but without reaching

24 the conclusion there is a fabrication. What would be wrong

25 with that?

1   **MS. BEIDEL:** I think that's the jury's role, Your

2   Honor. I'm not sure what is necessary --

3   **THE COURT:** No. Not saying the fabrication, but just

4   putting up the side-by-side comparisons.

5   **MS. BEIDEL:** So there is a case *Dorsey* in the Fourth

6   Circuit that talks about comparison of surveillance videos, for

7   example. The Court found that the jury's rule was supplanted

8   when the expert was essentially just comparing two things with

9   each other.

10   **THE COURT:** But these are not raw images. These are

11   things that had to be enhanced somehow through these tools, so

12   you would probably need somebody to explain why they look

13   different, these are different colors. What red means is this

14   and what orange means is that.

15   **MS. BEIDEL:** I think that's a little bit closer to,

16   you know, a custodian of a tool sort of evidence. This is the

17   kind of -- you know, a police officer talking about how they do

18   radar detection or a little closer to that if we are talking

19   about a tool as opposed to this overarching methodology.

20   **THE COURT:** And then what about his opinion in

21   looking at the two side-by-side images which maybe we can have

22   him put up and say, well, these are the same or different

23   because I look at the background noise and to me they look the

24   same or they look different or they are exactly the same?

25   **MS. BEIDEL:** I think there is a fundamental flaw in

1 | that opinion where he's not certain that he's comparing the

2 | right things. If it's not an apples-to-apples comparison, then

3 | that opinion doesn't have that, so if he does not have the

4 | correct original, which we -- it's our position that he does

5 | not -- and it does not matter whether or not the raw image

6 | matches the white box image. It does not foreclose the

7 | argument that we're making which is that the white box was

8 | pasted on top.

9 | **THE COURT:** Well, sure. But, again, that goes to --

10 | you're almost saying he should be able to say that, and we are

11 | going to have our other argument.

12 | **MS. BEIDEL:** I understand that goes to the weight in

13 | a sense, but I think it also goes to the reliability of the

14 | opinion. Because this is such a self-created standard for him,

15 | if he cannot foreclose the possibility that he had the wrong

16 | original, then it's not a reliable opinion.

17 | It's very similar to his colleague that he made an

18 | allegation against. If that person didn't have that original

19 | film and come in and tell him he was wrong, he would have

20 | persisted in the opinion. That's the case here, too. Dr. Wang

21 | should not be made to prove a negative. If these films existed

22 | and were destroyed for whatever reason by CUNY or not collected

23 | by the government, that's not on him, and I don't think that

24 | that makes the method reliable.

25 | **THE COURT:** What about the other parts of his

1 opinions or expertise? It seems that there is no dispute that

2 he has some expert on using Western blots. He tried to show

3 how they work. Any problem with the government having somebody

4 do that just so the jury understands what a Western blot is?

5   **MS. BEIDEL:** No, Your Honor. No problem with that.

6   **THE COURT:** And what about his data analysis? We

7 have this, in some cases it was less about the image and more

8 about the data. For example, the pH scale. At one point I

9 think he said, well, this doesn't match with the way things

10 work.

11   **MS. BEIDEL:** Our biggest problem with things like the

12 data analysis, Your Honor, is it seems like a choose your own

13 adventure method. Whatever image he gets to, he uses whatever

14 tools he thinks are appropriate in that circumstance. There is

15 not some application of that tool in other images to make the

16 counter-veiling point that it does not prove that point, that

17 the data is fine, and all the other circumstance, for example,

18 or that the histogram analysis only shows that one out of the

19 13 images appears to have been manipulated.

20   So a method generally is a step-by-step analysis requiring

21 conclusions to be reached or not. And this feels like he's

22 just, you know, applying his experience to choose whatever

23 method he thinks is appropriate under the circumstances.

24   **THE COURT:** But in terms of the method of saying --

25 and, again, I have to go back and look at the transcript to get

1 the exact opinion, but my sense of the flavor of it was that

2 this pH scale is something that comes into play and the data

3 does not match with the way it would actually turn out with a

4 legitimate scientific experience. And then the same thing with

5 this terminal digit analysis he's got. I mean --

6   **MS. BEIDEL:** Yeah. I suppose if those were part of

7 generally accepted methods of image analysis, then we wouldn't

8 have a problem with it. I'm not so much fighting the substance

9 of those things. I'm fighting the conclusion --

10   **THE COURT:** Not part of the analysis.

11   **MS. BEIDEL:** -- that there is no generally accepted

12 method for this kind of analysis in the community. He calls

13 himself -- he's out -- he's operating outside the scope of his

14 university. There is no peer review process at the university

15 that looks into that. They make sure he's separate. He

16 doesn't have any coauthors on any of these papers on this

17 topic, which is pretty unheard of.

18   There is people on blogs all over the place either

19 espousing his view or the opposite. And if we bring that level

20 of discourse in to a criminal courtroom, it really sets a

21 dangerous precedent.

22   **THE COURT:** Okay. Anything else you want to offer at

23 this point?

24   **MS. BEIDEL:** That's it, Your Honor. Thank you.

25   **THE COURT:** Mr. Tyler?

1   **MR. TYLER:** A few points I would like to emphasize.

2   First of all, just to -- I'm not sure Your Honor is aware,

3   but we engaged with the Daubert factor. If you read Daubert

4   itself, it says, many factors will bear on the inquiry as we do

5   not presume to set out a definitive checklist or task, but some

6   general obligations are appropriate and that --

7   **THE COURT:** Can you please just speak a little slower

8   for the court reporter.

9   **MR. TYLER:** Yes. I apologize.

10   And the Fourth Circuit in the *United States versus Crisp*,

11 at 324 F.3d 261 says, as the Court explains -- the Supreme

12 Court -- the addition of the new factors will put an end to

13 wholesale exclusion of expert testimony based on scientific

14 innovations under an uncompromising and general acceptance

15 test.

16   Now, I think what we hear from the defense here is like a

17 broad-based attack, not achieving have --

18   **THE COURT:** Let me start with some background. You

19 mentioned Daubert. Just make sure I'm not missing something.

20   Dr. Brookes has never testified as an expert; is that

21 correct?

22   **MR. TYLER:** That's correct.

23   **THE COURT:** Are you aware of any other expert who's

24 testified in this field in a criminal case or a civil case in

25 federal court or state court?

1   **MR. TYLER:** No.

2   **THE COURT:** So you can't find anybody else, so it's

3   not as if there are other experts who know more. This is as

4   good as it's going to get, it seems?

5   **MR. TYLER:** Yes. I mean, that is correct. I mean,

6   there is ORI which I was going to say about something about in

7   a second.

8   **THE COURT:** On ORI, I wanted to understand what is

9   the state of the record on that because as I looked at it, it

10   seems as if ORI is concerned about this issue. I think they

11   probably don't do a lot of their own investigations. It seems

12   like they set some standards or guidelines because I guess a

13   university is probably supposed to self-police maybe, but then

14   they put out things liking the droplet and say, you can use

15   this to try to figure out what is going on, but they don't

16   really explain how to do it and they don't set any guidelines

17   on sort of how sure you have to be or whether certain tools

18   will show something that clearly shows a misconduct or not.

19   But they give, at least, some tools, at least one of which,

20   maybe more, Dr. Brookes uses, but they don't kind of have a

21   standard methodology that they can say -- that Dr. Brookes

22   follows. He's not following anything that ORI set up, other

23   than perhaps using some of these tools that we have talked

24   about.

25   **MR. TYLER:** Yes. A couple things on that, Your

1   Honor.

2   First of all, just broadly, based on our interview of a

3   couple of our people, one in particular, our understanding is

4   you are right. In a lot of cases, ORI directs the university

5   to go out and conduct an investigation and they would give a

6   lot of input and advice about ways they may be.

7   In some instances, ORI does the investigation themselves

8   if they are not satisfied with what the university or other

9   institution did, and we --

10   **THE COURT:** So they have to have staff for that?

11   **MR. TYLER:** Yes. They have ORI investigators.

12   Scientific investigators.

13   One of them, who we interviewed, talked about how they use

14   magnification and comparison, contrast and brightness

15   adjustment, curves functions, gradient maps and densitometry

16   analysis in the work that they do to reach their --

17   **THE COURT:** Okay. Hold on a second. I think I

18   jotted those down. I am familiar with those.

19   Do they use the other techniques? So do they use the

20   histograms? Do they use terminal digit analysis? Do they use

21   pH scale analysis or things like that? Have they ever done

22   that.

23   **MR. TYLER:** I don't know if they have ever done that.

24   The things I gave you are the common things that Dr. Brookes

25   also does.

1   **THE COURT:** Sure. And the droplets, I assume,

2   because that is kind of their thing.

3   **MR. TYLER:** Yes. And that actually leads to the

4   other point which is we submitted a little over a dozen of Dr.

5   Brookes' reports to ORI during our investigation, frankly,

6   because none of us are scientists, and we wanted to make sure

7   we were understanding things correctly. And they basically

8   said, yeah. This looks good to us, and they gave some feedback

9   about, frankly, doing some more ORI droplets which is what

10 resulted in the final reports.

11   **THE COURT:** Why is nobody from ORI testifying?

12   **MR. TYLER:** The short answer on that is that the --

13 the short answer on that is that because that is not who the

14 expert is who we employed. Frankly, at the time we did it, I

15 don't think we had a full understanding of what ORI did.

16   **THE COURT:** Okay. So the aspect of ORI I had some

17 uncertainty about was to what extent Dr. Brookes has done work

18 or submitted reports in other matters to ORI, and they have

19 said -- they have sort of validated his results and to what

20 extent any record of that one way or the other. Some of it is

21 have they actually said yes. Your analysis was correct. And

22 you did it the right way. And to what extent is it sort of

23 more circumstantial like, well, he submitted something to

24 somebody and it ended up at ORI and then somebody else got

25 suspended, but we don't know exactly how the line runs through

1 those things.

2   **MR. TYLER:** I think it's somewhere between those

3 things. Dr. Brookes, as I understand it, submitted his

4 referral directly to ORI, but I don't know that we have insight

5 in to whether they accepted that in total or they did

6 additional work themselves, but like what we do know is --

7   **THE COURT:** Submitted something you mean about this

8 case or about other cases?

9   **MR. TYLER:** About other cases. And some of that

10 would be found in the scientific integrity CV if you look at

11 that. So he submitted like referral information he did to ORI

12 and ORI ultimately made a finding. I don't know that --

13   **THE COURT:** Is there a list there? I think there is

14 something where -- whether he's provided or someone else that

15 tells us how often that happened.

16   **MR. TYLER:** I think it's just two or three times

17 which I believe there is actually a footnote to our response,

18 if I remember correctly.

19   **THE COURT:** Are there times where he submitted

20 something and nothing came of it? Either they said, sorry, you

21 are wrong, or they just didn't react to it in any way that

22 showed validation of any kind?

23   **MR. TYLER:** I don't know the answer to that question.

24   **THE COURT:** So, if there is two or three that worked,

25 it may arguably in a circumstantial way showed that they agreed

 1 with him, we don't know what the total denominator is, how many

 2 times he did that?

 3   **MR. TYLER:** I can't tell you. I haven't asked that

 4 question. I can't tell you that.

 5   **THE COURT:** I take it ORI probably doesn't have that

 6 kind of data, like they are not tracking that kind of thing?

 7   **MR. TYLER:** I don't know that for a fact, but my

 8 impression is no.

 9   **THE COURT:** And then in terms of the literature we

10 have seen, it seems to me that there are articles that cover

11 this area or at least talk about it, less about doing an

12 experiment, and I think, as Dr. Brookes said, a few of them are

13 just, well, this is a problem, and we tried to figure out how

14 bad it is, and they use their own methodology to figure out how

15 often people engage in misconduct and came up with some numbers

16 sometimes using either an AI tool or this I think he said he

17 named something that came out of one of those like a

18 proprietary software that he said he can't get access to now.

19   **MR. TYLER:** A C lot.

20   **THE COURT:** C lot. Or one said he had like three

21 scientists looking at it together and deciding if they all

22 agreed. So they all had different ways of doing it to identify

23 the problem.

24   Is it fair to say that nobody has sort of used this

25 three-step process that's written about it that Dr. Brookes is

1 using here?

2   **MR. TYLER:** Not -- I don't think not specifically. I

3 think his testimony actually is the best which is like this

4 three-step thing is really just about figuring out if A goes to

5 B. Can the published image be tracked back to a raw image?

6 And like he laid out this way of doing it, but really that is

7 what really all of these articles are asking the question. Are

8 you using similar tools and different -- like different ways of

9 doing it, but that's the question that they're all talking or

10 using or all asking and they are all using at least some of the

11 same or similar tools.

12   **THE COURT:** So, other than using the same tools,

13 maybe some of which might be generally accepted, there is no

14 real general acceptance of his approach or methodology;

15 correct?

16   **MR. TYLER:** Not in like -- not framed in like

17 three-stage standard.

18   **THE COURT:** In terms of whether it's been published

19 in any way, I think the article I think that's closest is this

20 detection article, that he -- misconduct detection article. I

21 don't think it goes through the three steps. I think it lists

22 many of the technique, if that's right.

23   **MR. TYLER:** Yeah. That's my understanding, Your

24 Honor.

25   **THE COURT:** And as he described that he spoke and

1 they said everybody can submit an article. So his list of

2 techniques is published. Was that -- do you know if that's a

3 peer review process to be published for that or given the

4 symposium nature of it, it wasn't?

5   **MR. TYLER:** That is a fair question. I don't want to

6 answer without -- I don't know for sure the answer to that. So

7 I don't want to tell you the wrong answer.

8   **THE COURT:** Sure. I mean, I was inferring from the

9 way that you described it there was not necessarily a peer

10 review. But do you have any reason to or any information that

11 contradicts that in some way.

12   **MR. TYLER:** No. I don't know that.

13   **THE COURT:** So I think where you started on Daubert

14 you were saying -- and I think I agree with this -- and *Kumho*

15 *Tire*, too. There are these five factors. None of them are

16 dispositive. We are probably supposed to look at all of them

17 when there is any kind of technical stuff going on which is the

18 case here, so we will look at all of them.

19   We are not limited to those, but the five of them don't --

20 I mean, given that he's acknowledged it's a new field, they

21 don't really map on very easily to say, well, these five

22 factors all work so his methodology is totally set on.

23   For example, error rates and testing. This seems like the

24 kind of thing someone could test. You could get some images,

25 either fabricate them or just take existing images and run them

1 through somebody and say, hey, can you tell me if these are the

2 same or different, and you know the answer.

3   That is kind of happens with handwriting in the *Crisp*

4 case. They do testing, both broadly to see if their

5 methodology works, and also the individual examiner.

6   None of that has ever happened here; correct?

7   **MR. TYLER:** I mean, you -- I think you cited a Bik

8 case where she went through with some other co-authors and they

9 identified as to the --

10   **THE COURT:** I'm sorry. Say that again.

11   **MR. TYLER:** The Bik article which is one of the ones

12 where she goes through and like identifies, but it's not --

13 it's really the flip of that which is say we have identified

14 this number by this process, but not the error rate of the

15 actual process.

16   **THE COURT:** Is this the one where there are three

17 examiners looking at it together?

18   **MR. TYLER:** Yes.

19   **THE COURT:** But that's a different methodology?

20   **MR. TYLER:** Yes.

21   **THE COURT:** So he has not even done it himself. He

22 hasn't like tested it himself and said, hey, someone give me

23 all these images, and I'll tell you if they're fabricated or

24 not and see how I do.

25   **MR. TYLER:** I think that's right.

1   **THE COURT:** So, if the traditional factors, at least

2   don't obviously map on to the idea that this should be

3   considered reliable, what would you point to, again, since we

4   are not limited to those five factors, but given that it has

5   not been tested, and there is no error rate for his work, there

6   is no -- or the methodology is not generally accepted. What

7   would you point to to say, nevertheless it's reliable?

8   **MR. TYLER:** A couple things. One, I think you could

9   argue that the error rate is one instance. And I think he may

10   have said it in other sentences that we disclosed that he

11   estimates that would have been a percent or something of the

12   overall number of situations where he's alleged misconduct

13   based on the process that involved.

14   **THE COURT:** I'm sorry. What did you say about

15   one percent? How did he get there?

16   **MR. TYLER:** So he talked about the one instance where

17   he was confronted so, obviously, he admitted that was an error

18   there and like none of the other instances where he's

19   confronted has that happened to --

20   **THE COURT:** I'm not sure he said that. I think he

21   just --

22   **MR. TYLER:** Yes. But the point is like he's got all

23   these other papers, like hundreds of papers retracted, and this

24   is one instance.

25   **THE COURT:** Where does it say hundreds of papers? I

1   didn't hear him say that today.

2   **MR. TYLER:** That's in his -- that's actually in his

3   CV. He lists some of them.

4   **THE COURT:** Again, maybe I missed it, but the same

5   question as I had with ORI. Do we know what the denominator

6   is? If he's gotten a hundred retracted -- just as an example.

7   Let's pick a number of a hundred. How many has he submitted

8   something where there was no retraction? Do we know?

9   **MR. TYLER:** I don't know that, Your Honor.

10   If I may, though, to answer your original question is

11 like -- is, frankly, part of what Ms. Beidel said which is like

12 we are not even contesting that these things match. That was a

13 lot of what the point of today was from our perspective was to

14 actually like show the work, demonstrate the reliability of

15 this using multiple tests with tools that Dr. Brookes did not

16 invent and that are generally accepted and available. And

17 using those tools like walk you through why this is reliable.

18   The defense's argument is all like a broadside against

19 this idea of like what are the standards without actually

20 engaging with like, there is something unreliable about this

21 conclusion he reached or about this analysis he did. And the

22 reason for that is because, notwithstanding the fact that like

23 it would be hard for a juror to understand what was going on in

24 looking at this cold, but like you can actually see it and it

25 is apparent.

1   **THE COURT:** Let me ask this: A couple times he said

2   there is a digital fingerprint, and that caught my attention

3   because, as you know, fingerprint analysis is under fire now.

4   It used to be everybody thought these were exactly the same.

5   And they have a lot of standards. They have five points of

6   comparison that need to be matched between two different

7   fingerprints and even then, if we don't have absolute

8   certainty. He said just by looking at the background noise, as

9   he called it on these two, he could tell they are exactly the

10   same or different. There is a digital fingerprint there and so

11   he is certain that this slide came from that one.

12   I understand the notion of saying, well, there is a common

13   sense -- it makes sense to me if he says as someone who uses

14   Western blots that if you go back and try to use the same thing

15   twice, it is not going to have the same background noise. But

16   even that, when we have years and years of fingerprint

17   analysis, it is not certain that two people don't have the same

18   fingerprint.

19   How can you be so certain about that? What is he basing

20   that on?

21   **MR. TYLER:** I think in that instance when he's

22   talking about the matching background, the point is instead of

23   like --

24   **THE COURT:** And we don't have five points of

25   comparison between the two backgrounds. I just have a fuzzy

1 image on a screen, and I'm taking his word for it that they're

2 exactly the same even more so than two fingerprints are exactly

3 the same.

4   **MR. TYLER:** I think what he would say is he would

5 point you to there is way more than five commonalities here

6 that I can point you to, and these are the ones that I looked

7 at when I made that comparison.

8   **THE COURT:** But what's the standard for how many you

9 have to match to say these are exactly the same?

10   **MR. TYLER:** I mean, I think his testimony governs it

11 right there. I don't think we can point to --

12   **THE COURT:** So how is this more reliable than

13 fingerprint evidence, which is in question, or handwriting

14 analysis where you compare different parts of handwriting which

15 has been vastly tested? This has never been tested. It is

16 just what he's saying.

17   **MR. TYLER:** I think the answer to that is the

18 difference between fingerprint analysis is really the

19 fingerprint analysis is you are comparing people's -- everybody

20 has like a bunch of fingerprints. And you are just really

21 trying to like figure out like this line versus that line.

22 Right.

23   Here you have like the things -- whatever are the

24 fingerprints here are not necessarily -- especially if you are

25 talking about the background artifacts, like they like don't

1 all have to be here. The fact that they are emerging in the --

2 in the way that they are with the -- you know, with the

3 orientation, with spacing, with the size and shape, like that

4 like just --

5   **THE COURT:** How do we know they don't just have a

6 sort of a particular thing that's stuck on the glass somewhere?

7 How do we know these things? How is he so sure?

8   **MR. TYLER:** I mean, I think that the answer to that

9 is based on the experience that he's been doing this for 20

10 years, that he knows that this is how this works.

11   **THE COURT:** Does anybody else do that analysis? I

12 didn't see any other articles where there was a discussion not

13 about how you look at the bars or the bands, but the background

14 noise piece. I didn't see that as a discussion point of here

15 is how you tell the background noise tells you these are the

16 exact same things.

17   Does anybody else do that, other than Dr. Brookes?

18   **MR. TYLER:** I am not aware of -- I'm not aware.

19   **THE COURT:** Does ORI use that type of analysis?

20 Does ORI have any standards for that?

21   **MR. TYLER:** Not that I know of.

22   Your Honor, just to also close a loop on that. Obviously,

23 it's not just the -- you've got the handwriting. You've got

24 the file name. There is like more than just one data point

25 here, so we think that all of the -- like, obviously, that is

1 part of this as well.

2   **THE COURT:** Okay. So --

3   **MR. TYLER:** Your Honor, if I could point out one

4 other thing, which I --

5   **THE COURT:** Sure.

6   **MR. TYLER:** -- thought would posit just on sort of

7 looking at this through a different rubric. I mean, 702 and

8 *Kumho Tire* both explicitly talk about experience being a basis

9 like on its own.

10   In the notes on 702 it says, nothing in this amendment is

11 intended to suggest that experience alone, or experience in

12 conjunction with other knowledge, skill, training or education

13 may not provide a sufficient foundation for expert testimony.

14   To the contrary, the text of Rule 702 expressly

15 contemplates that an expert may be qualified on the basis of

16 experience. In certain fields, experience is the predominant,

17 if not sole basis, for a great deal of reliable expert

18 testimony.

19   And then *Kumho Tire* it says, no one denies that an expert

20 might draw a conclusion from a set of observations based on

21 extensive and specialized experience.

22   **THE COURT:** So a lot of times that's like our drug

23 agents who know the lingo. This does seem like we are not far

24 off from the *Kumho Tire* situation where there is an element of

25 science involved. Clearly, I don't think anybody off the

1   street could do what Dr. Brookes is doing. I disagree that

2   this is like the photograph case because you have to know

3   something about these Western blots to do some of this.

4   But I think they had an engineer in *Kumho Tire* and it's

5   unclear to me whether, you know, just saying I've looked at

6   these things a lot is enough in that context.

7   So is there a case that you think is a good factual

8   comparator for our situation where it's perhaps not entirely

9   pure science, but is also not just someone saying, look, I've

10   heard a lot of drug dealers talk, and this is how they talk.

11   **MR. TYLER:** I mean, I'm -- I think that the --

12   frankly, I think that the handwriting cases are probably the

13   closest. I don't -- like -- as I said before, I don't think

14   there is any direct analysis in this case here.

15   I think the handwriting case probably is the closest

16   because there is a degree of reliability to it, but there is a

17   degree of subjectivity.

18   In this case, in my view, it is even more objective here

19   because it's not like, are the things like leaned over this

20   much, but it's more based on like this program and this tool is

21   doing this and making this assessment, and I'm just like

22   reading what the results of that are.

23   **THE COURT:** There is no tool being involved with this

24   background noise issue, though. Right? It is really just the

25   ones that try to overlay the bands from the tests; correct?

1   **MR. TYLER:** Yeah. I mean, he said that -- he

2   apologized that he did not do the ORI droplet, but like

3   conceivably, you could do an ORI droplet on that background and

4   get to some sort of result. Obviously, that's not part of what

5   we posed here, but I guess that would be one way to do it.

6   **THE COURT:** What about the data issues that we heard

7   about the pH scale, the terminology digits? I mean, I think

8   because we are not -- I think part of the nature of the hearing

9   didn't lend itself to sort of challenging every single piece of

10   evidence. What's the basis for the reliability of those pieces

11   of information?

12   **MR. TYLER:** I mean, I think the pH scale one is just

13   the fact that he's -- this is like why his expertise is

14   particularly important -- because he's able to say the way you

15   run this, you run top to bottom. And if you look at what they

16   have done, if you run it top to bottom, the bottom is now zero,

17   which is an impossible pH -- an impossible pH level.

18   **THE COURT:** I, frankly, didn't fully understand it

19   because there was a step in the middle called the vertical

20   stretch, and I didn't understand what that was. I also didn't

21   understand whether that made a difference.

22   **MR. TYLER:** The vertical stretch was just matching

23   what he was doing in the middle with the same scale of the

24   published image and make sure they were oriented in the same

25   way so you could actually transfer over in the 3.95 in to 9.5.

1   That's an example where his point is that like -- like I

2 know this because I'm a scientist and you have to run these

3 things top to bottom, but the problem with this is if you

4 actually look, the bottom is like not a -- is like a pH scale.

5 It is not possible.

6   **THE COURT:** I guess I would have to go back and read

7 it again. I guess I didn't fully get it the first time through

8 how we know that we are below the scale in some form.

9   **MR. TYLER:** Your Honor, also, all the stuff that we

10 went over is like in -- so if we are talking about Exhibit-10A,

11 Exhibit-10 is the report where he actually like gives a

12 narrative explanation for that, so that's also -- that's not

13 only just the testimony, but that's also a place where he's

14 explaining it.

15   **THE COURT:** Okay. So, other than the handwriting

16 comparison that seems as if just in terms of other indicia of

17 reliability beyond just the five factors, it's more just it

18 sounded good. Is that basically the analysis, like he got up

19 there and it makes sense? I don't disagree a lot of it makes

20 sense, but is that really -- is that what I'm supposed to go on

21 or --

22   **MR. TYLER:** I would not characterize it as that. But

23 just like he's showing the actual step and that was the purpose

24 of that initial PowerPoint is just like I'm showing you the

25 steps that I have done. This is like a reliable software

1 program. And this is what we get here and what this is what we

2 get here. And all I'm doing is I'm running those --

3 objectively running those programs, and then the result of that

4 is just going to be what the comparison is, and then that is

5 what it is.

6   The matching -- I mean, the version forward analysis, like

7 when you actually like do the step-by-step process, it's

8 reliable, and it's also reinforcing because you have the

9 gradient analysis which matches like the magnification and

10 orientation that matches the droplets.

11   So in those instances, you have multiple ways that is

12 actually like corroborating or reinforcing the reliability when

13 you are looking at the actual analysis being done.

14   **THE COURT:** So, even if we take the view that some of

15 these steps, like I was telling Ms. Beidel, you are just going

16 to put up the gradient image, it's easier to tell what is going

17 on from the colors. Someone can accept the notion that there

18 is nothing sort of -- the technology is not sort of changing

19 it. It is just making it easier to see, and Dr. Brookes can

20 say it's easier to see.

21   How do you get from there to, "in my expert opinion, this

22 has been fabricated?" Again, to do that kind of opinion I

23 think usually the standard for, again, how reliable it is,

24 probably should be higher. And I'm not sure, frankly, in any

25 of these circumstantial instances we have, whether it's ORIs,

1 debarring somebody or somebody withdrawing their paper, that we

2 really have any examples where there is a through line from

3 using these techniques to finding that something has actually

4 been fabricated.

5   **MR. TYLER:** I mean, it's a different standard, but

6 overall, if you look at their actual finding, it's a number of

7 them find that there has been falsification or fabrication.

8 You have a different standard here.

9   **THE COURT:** So the background on those is not

10 available to anybody? Like the details of those -- again, all

11 I have is the results. I don't know what methodology they

12 reached to reach that conclusion. I don't have what their

13 standard of review is, how high the bar is as a matter of

14 evidence. Do they use the same techniques that -- I mean, Dr.

15 Brookes is only using not all of his A techniques anyways.

16 Which ones did they use? Did they use anything about terminal

17 digit analysis? I mean, I don't really know. Is that written

18 down anywhere?

19   **MR. TYLER:** I mean, I think some of -- the short

20 answer -- the thing that I think comes to mind right now is we

21 have -- like during the course of this, we have like a draft

22 declaration that was submitted to an ALG and one of the judges.

23 It's not signed. I don't know if it's final or not, but it

24 does go through a lot of the same analysis that Dr. Brookes

25 does. There is no terminal digit analysis in there, but it

1 talks about using the ORI droplets in current files and there

2 is a formal declaration that's done by the actual ORI

3 investigator.

4   **THE COURT:** Does Dr. Brookes claim any expertise on

5 terminal digit analysis because it is not -- it's not -- it

6 seems like it makes sense. At the same time I don't know if

7 it's appropriate to say you are just going to do a standard

8 sort of -- you know, he's not a statistician. He decided what

9 he thought was the relevant statistical analysis. I don't know

10 if that is legitimate or generally accepted or anything like

11 that.

12   **MR. TYLER:** I think that's fair. I mean, obviously,

13 like you can tell, again, just by going through the

14 spreadsheets, yes, he has a lot of statistical knowledge and he

15 did have graduate statistical training in order to just do what

16 he does, but he's not a statistician, which is true.

17   **THE COURT:** Let me ask you this: I have to -- I'm

18 going to have to think about this. One scenario, though, might

19 be along the lines of, as I said with Ms. Beidel, maybe he gets

20 to show the work he did in comparing some of these documents

21 using these tools which are somewhat uncontroversial, like the

22 ORI droplets and putting up images about how this is what the

23 side by side looks like. Maybe pointing out things based on

24 his knowledge more as a user of Western blots as to what some

25 of the similarities or differences might mean from a scientific

1 standpoint, but maybe perhaps saying, well, there are certain

2 opinions you may be able to give and certain maybe you can't

3 because they're just not -- methodology doesn't lend itself to

4 saying, for example, this is entirely fabricated.

5   What I'm concerned about if I were to do something like

6 that is, from his testimony, he just seems to be very confident

7 in his views. And if I said, look, you can't call something a

8 digital fingerprint, he might actually just do that anyways.

9 That's the impression I get about him. Or if I say don't say

10 it's fabricated, he might just do that anyways.

11   What controls would there be on a situation like that, or

12 is that just not helpful to you? Would you just rather have

13 all or nothing with him?

14   **MR. TYLER:** We would rather have an all or nothing.

15 I do think that we can -- and, frankly, obviously, we prepared

16 him in advance of today. And I do think that we can absolutely

17 cabin this as necessary consistent with the Court's order.

18   **THE COURT:** Okay. Any other arguments you want to

19 offer at this point?

20   **MR. TYLER:** Can I have a moment?

21   **THE COURT:** Uh-hum.

22   **MR. TYLER:** I don't think anything else, Your Honor.

23 I think I made my points, unless you have any -- we

24 obviously -- I'm happy to address like any more specific

25 comments, but I think the most -- from our perspective, the

1 most important piece here is like the actual analysis itself

2 and like walking through that is what shows it's reliable.

3   **THE COURT:** Isn't that a sort of chicken or the egg

4 thing? I mean --

5   **MR. TYLER:** I don't know about that because like if

6 you say like this handwriting matches whatever. And you are

7 just like, that's just like an opinion based on like, oh, I

8 have done some training and this is the standard or whatever

9 versus like I'm going to show you how this stuff actually

10 works, and I'm going to show you how this stuff matches.

11 That -- I'm not going to ask you to take my word for it. I am

12 going to -- I -- and I did today demonstrate to you like how

13 this is reliable and how you can actually see that there are

14 multiple ways to verify that this is reliable.

15   **THE COURT:** So I understand that you can do a side by

16 side just as you can with handwriting, and you can point out

17 where there is things look the same and things that don't look

18 the same, and the handwriting expert can then, at least if

19 they're admitted -- and I don't think it's a universal thing,

20 but it's -- they can say, you know, based on the way on these

21 various points of comparison, I think it's the same person.

22 I'm not totally sure whether, again, on testing on that they

23 have done, you know, a lot of different work not just on the

24 technique, but also on the individual person as opposed to

25 just -- so there is that part where it makes sense. The rest

1 of it I have to think about.

2   The question I had was: I read the defense's

3 submission -- and, again, I'm not saying we are resolving this

4 all at the same time, but we might. They have their two

5 experts. It seemed as if, first of all, they don't need them

6 if they don't have Dr. Brookes here. But if they have Dr.

7 Brookes here, then they -- it seemed like your arguments were

8 more that they were not relevant. And I think, for example,

9 you say that there will be no dispute that meta data does not

10 trace back, although Dr. Brookes does not have anything to say

11 on that one way or the other. He didn't try to do that.

12   So, if I agree with you that, even if it's undisputed, I

13 mean, if they want to make the point that there is no meta data

14 or forensic way to tie these things together, other than I

15 think the main connection is Dr. Brookes saying the background

16 looks the same, ergo they are the same.

17   How would they get that into evidence or how could they

18 argue that if they don't have somebody saying -- because he

19 won't be able to say that one way or the other?

20   **MR. TYLER:** Well, I think he did say that is that I

21 didn't do any of this. I think is the point that they are

22 trying to make is that like not -- frankly, it's probably a

23 better point for them which is that like not only did they not

24 do it, but he like didn't even consider or do it all. Right.

25   So, I mean, I guess I think that that comes in.

1   **THE COURT:** Okay.

2   **MR. TYLER:** With also one other thing is like, Your

3   Honor should have probably picked up on this some, but like

4   some of this testimony is going to connect up with what Special

5   Agent Weeks testifies about what he saw in the files and what

6   like, you know, some of the like time stamps and whatever that

7   were associated with the actual underlying files that were

8   provided to Dr. Brookes.

9   So there will be some connection in terms of that, but,

10 obviously, Dr. Brookes only has what he's given.

11   **THE COURT:** Okay. And then the other expert was

12 about a literature search and on the one hand -- I mean, I

13 think it's specialized enough that it's not -- an ordinary

14 juror would not know where to look, I think, or how to read

15 anything that they found, so you are sort of saying maybe it

16 does not really matter or maybe it does because you said, well,

17 there are articles that he didn't find that are relevant, but

18 they are some of the same ones we have talked about.

19   Dr. Brookes seems to give the view that, well, you know,

20 it's all out there. Everybody is doing it. And what is wrong

21 with somebody saying, well, I don't really see any articles

22 that talk about this methodology in the same way.

23   **MR. TYLER:** I mean, I think that that's -- I think

24 that one of the issues with that is that he reached that

25 opinion before he even reviewed Dr. Brookes' methodology.

1   So I think like to reach that conclusion without

2   describing what you -- providing no basis for what you have

3   done, to reach that conclusion, and then haven't even reviewed

4   his methodology is like pretty indicative of a deficient

5   methodology in the first place.

6   THE COURT: Okay. That's fair. Anything else on any

7   of the experts?

8   MR. TYLER: Unless you have any questions, like I

9   think our papers stand for themselves on both those issues.

10   THE COURT: Okay. I mean, I do think that they're --

11 I'm hoping by going back it will be more clear exactly what his

12 testimony will be because I think that, to the extent that I

13 allow it, if with certain kinds of restrictions, it's kind of

14 hard to do that without knowing the full scope, so we may come

15 back for more clarification if it gets that far.

16   Ms. Beidel, anything else you want to offer? I know we

17 are --

18   MR. TYLER: Your Honor, just to --

19   THE COURT: I told the other case that we would start

20 at 3:00, so I don't want to run too much longer. We gave you

21 an extra half hour, but if there is anything you want to

22 respond to quickly.

23   Was there one last point, Mr. Tyler?

24   MR. TYLER: I just wanted to point out that like when

25 you actually look at the reports, most of it is -- most of the

1 reports is like that forward and reverse analysis, so that's

2 like the core of it. Even though we covered a lot of other

3 stuff, like that is the feature that is most repeated across

4 the rules.

5   **THE COURT:** I see. Thank you.

6   **MS. BEIDEL:** Just on that last point with respect to

7 Dr. Cheaito, Your Honor, he did review the substantive reports

8 at the time that he issued the opinion which contains the

9 forward analysis and reverse analysis. And we told him that

10 was the method.

11   So, after the government pointed that out, we made sure he

12 got reports one through three for completeness, but he

13 understood the analysis and the methodology at the time that he

14 issued his opinions.

15   **THE COURT:** Okay. Do you need those two experts --

16 if Dr. Brookes gets to testify, do all of you want them or does

17 it depend on what his opinions or what he's allowed to testify

18 to and what he's not allowed to testify to?

19   **MS. BEIDEL:** Our view is if he's allowed to testify,

20 we do think we would need the experts to talk about the

21 methodology. I spes -- I can't envision exactly what the Court

22 would allow.

23   Certainly if there was a different methodology or subset

24 of methodology being applied, then we would talk to Dr. Cheaito

25 about whether he thought that was acceptable and his opinion

1 would change.

2   The meta data analysis we do think is critical, so going

3 to this point of the digital footprint, there is usually a

4 digital fingerprint. It's in the meta data, this MD5 hash

5 value and it doesn't exist.

6   So, especially given the potential possibility that Dr.

7 Brookes would go beyond whatever limitations are imposed, we do

8 think that is necessary for our rebuttal, if nothing else.

9   One other thing, I did want to flag on the ORI denominator

10 and I guess the other denominator about retracted papers. In

11 our view, that's Brady. If that evidence exists within the

12 government about issues with Dr. Brookes' reports, if there is

13 ones that ORI turned down, we think that we are entitled to see

14 that material prior to trial.

15   **THE COURT:** Okay. I mean, that's a good point. I

16 don't know if I -- it may or may not be Brady, but I certainly

17 think it would be material to the defense to know that. So

18 either way, it sounds like you don't have that information; is

19 that correct, Mr. Tyler?

20   **MR. TYLER:** That's correct.

21   **THE COURT:** Okay. So, as you can tell, I need a

22 little time to think about this and review what we heard today

23 from Dr. Brookes and what your responses were to the questions.

24 And, you know, it's actually kind of unusual to have a proposed

25 expert who's, A, never been an expert. Usually they come in

1   and say, "I've done this 50 times," or someone who is also in a

2   relatively new field.

3   So, forgive me if I need a little more time on it.

4   The only thing I want to try to figure out is what is the

5   timeline between now and the trial. I think we have one motion

6   in limine which is not unrelated to all this.

7   I think the response date for that and for the jury

8   instructions I think is tomorrow or something like that.

9   Usually I try to sort out motions in limine and jury

10 instruction disputes, if there are any. We hope it will be

11 jointly agreed to. And we discuss voir dire questions and the

12 like at the pretrial conference itself.

13   I guess one question is: Does it present problems for the

14 parties if the ruling on the expert motions in limine doesn't

15 come until the pretrial conference? Is there some compelling

16 need to have an answer before that?

17   **MR. TYLER:** Your Honor, not from the government's

18 perspective. I think our intention is to prepare. Obviously,

19 I mean, one benefit of today is we did, obviously, a lot of

20 preparation of Dr. Brookes already.

21   **THE COURT:** That's right.

22   **MR. TYLER:** And like, obviously, we didn't go through

23 all the reports, but we got like a model of what it would look

24 like and so we will continue to prepare in that fashion.

25   **THE COURT:** Ms. Beidel, any issues with that?

 1   **MS. BEIDEL:** We can make that work, Your Honor.

 2   **THE COURT:** I mean, I would like to try to resolve

 3 this earlier in part because there is these other issues to

 4 sort out so, you know, if I can do it sooner than that, I'll

 5 let you know, but I also wanted to see what problems might be

 6 created by that.

 7   And then in terms of -- I take it the government did not

 8 file any motions in limine; correct?

 9   **MR. TYLER:** That's correct, Your Honor.

10   **THE COURT:** So we will have that one motion. We will

11 have the jury instructions which, again, I hope will be agreed

12 to, voir dire, verdict forms.

13   Any other issues that the parties want to discuss at the

14 pretrial conference, I do -- while we are here, is there

15 anything else that it would be better for me to know about now

16 than at the pretrial conference for playing purposes?

17   MR. SRIDHARAN: I think one thing, Your Honor, on the

18 jury instructions, we are working through our various positions

19 on them. A lot of them relate to the same pattern involved

20 sending the indictment language back. And there is, you

21 know -- so a lot of our back and forth are about kind of the

22 scope of that and, obviously, every courtroom is different on

23 that, so I think it would be helpful to know Your Honor's

24 preference.

25   **THE COURT:** About sending the indictment back?

1   MR. SRIDHARAN: Indictment language in the jury

2 instructions or whether Your Honor sends the indictment back.

3 Generally, you know, so I think that would kind of help

4 shortcut some of the --

5   **THE COURT:** Have you talked to the U.S. Attorney's

6 Office about this? You have local counsel.

7   MR. SRIDHARAN: We will reach out to the U.S.

8 Attorney's office and see.

9   **THE COURT:** I think, generally speaking, I don't have

10 any hard and fast rules. What I generally understood is that

11 many times one side or the other, oftentimes the defense, would

12 prefer not to have the full indictment go to the jury. I

13 don't -- not always. Sometimes.

14   But my general approach is, I don't send the full

15 indictment back as a matter of course. If one side objects,

16 I'm less likely to do so.

17   But two things can come into play. One is that some of

18 the language, like the very core language of the indictment,

19 not sort of descriptive language, but just as an example

20 looking at this, there is paragraph 39 on false statements,

21 many times that will be -- that language will be in the jury

22 instructions when we are introducing the false statement

23 charge, so that the parties -- the jury knows the exact date

24 we're talking about. It's basically just the statutory

25 language and I probably would include the statutory language

1 anyway.

2   So a paragraph like that usually shows up. Not always.

3 In saying that -- you know, and the same would be true of like

4 a wire fraud charge we might have some of the language from

5 paragraph 34, and certainly some of the language from Count Two

6 or Three just describing what the wire is.

7   But the full indictment as a full document or even the

8 full text, ordinarily I would not include. One exception is if

9 particularly in a conspiracy case, which I don't think this is,

10 but sometimes there is other things where it's material for

11 them to know. For example, what are the overt acts alleged.

12   So, then, that might be reason to send the whole

13 indictment back which we sometimes do, or if one side would

14 prefer doing it a different way, we can sometimes give the jury

15 sort of a list of overt acts which is basically just a cut and

16 paste from the indictment, but it's not called the indictment.

17 It's just saying these are the things -- the overt acts have

18 been charged. Sometimes we take subparts and use them because

19 they are material.

20   There are sometimes when both sides agree, we will send

21 the whole indictment back. So there is a range. That is

22 generally how I have seen it.

23   MR. SRIDHARAN: I appreciate that, Your Honor, I

24 think the method you described is what we just did in Judge

25 Xinis' courtroom for a trial I did last year, so that is what I

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 1   was planning on proposing, but I --

 2             THE COURT:  Which one?

 3             MR. SRIDHARAN:  About including the charging

 4   language.

 5             THE COURT:  Excerpts, but not the full indictment.

 6             MR. SRIDHARAN:  Excerpts, but not the full

 7   indictment.

 8             And that we also did have conspiracy, so that we did

 9   copy in the overt acts, but that's not the issue here.

10             THE COURT:  Anything else that would be helpful for

11   me to know or you to know before the pretrial conference?

12             MS. BEIDEL:  No, Your Honor.  Thank you.

13             MR. TYLER:  Nothing from the government.

14             THE COURT:  Okay.  And in the meantime, you know, you

15   may get questions from Ms. Solomon for our planning purposes.

16   Please try to respond as promptly and thoroughly as possible

17   and, conversely, if there is some logistical issue that you

18   need guidance on, you can try asking her.  I'm not promising it

19   will be an appropriate thing for her to have to respond to, or

20   certainly file something in advance along with everything else.

21       So we will get back to you as soon as we can on this

22   issue.  Thank you for the argument and the testimony of the

23   witness.  It's been very helpful.  Thank you.

24             DEPUTY CLERK:  All rise.  This Honorable Court now

25   stands in recess.
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1   (Proceedings concluded at 3:10 p.m.)

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3   C E R T I F I C A T E

4   I, KIMBERLY A. BURSNER, Federal Official Court

5   Reporter in and for the United States District Court for the

6   District of Maryland, do hereby certify, pursuant to 28 U.S.C.

7   §753, that the foregoing is a true and correct transcript of

8   the stenographically-reported proceedings held in the

9   above-entitled matter and the transcript page format is in

10   conformance with the regulations of the Judicial Conference of

11   the United States.

12

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15   Registered Professional
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